# DIRECTIONS

THE FINAL
REPORT OF
THE ROYAL
COMMISSION
ON NATIONAL
PASSENGER
TRANSPORTATION

## SUMMARY

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# DIRECTIONS

# THE FINAL REPORT OF THE ROYAL COMMISSION ON NATIONAL PASSENGER TRANSPORTATION

## SUMMARY

The Royal Commission on National Passenger Transportation recognizes that transportation touches everyone's life and that information concerning our recommendations for Canada's passenger transportation system in the 21st century must reach as many Canadians as possible.

For these reasons, the Royal Commission is publishing this summary of our final report, *Directions.* The summary provides a brief overview of our principal findings and recommendations; we hope that it will persuade the reader to read the final report.

*Directions: The Final Report of the Royal Commission on National Passenger Transportation* is published in four volumes and is available through local public libraries across the country. It may also be purchased directly from the Canada Communication Group — Publishing and is available through your local bookseller. To find out how you may purchase the complete four-volume set of *Directions,* or the sub-set of Volumes 1 and 2 (Findings and Recommendations, and Supporting Documentation), please call: (819) 956-4802.

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## WHAT THE GOVERNMENT OF CANADA ASKED THE ROYAL COMMISSION TO DO

Around the world, transportation is undergoing rapid, major change. Many countries are trying new ways to finance transportation infrastructure and to deliver passenger transportation services to the marketplace. Changing government economic regulation over the delivery of passenger transportation services has resulted in new approaches to meeting travellers' needs.

This pace of change will continue and Canadians cannot ignore these innovations in other parts of the world and the challenges that they present. As the economies of nations become more and more interdependent, the choices that Canadians make about passenger transportation projects and investment will affect Canada's economic success in the global marketplace. It is therefore important to make the right passenger transportation decisions now.

In 1990, Canadians devoted substantially more resources to transportation than to health care (16 percent of gross domestic product (GDP) compared with 9 percent of the GDP). In dollar figures, we estimate that in 1991, Canadians spent between $30 billion to $45 billion, or an average of $1,100 to $1,700 per person, on intercity passenger transportation itself.

Canada has changed dramatically since the MacPherson Royal Commission issued its report on transportation 30 years ago. We believe it is now opportune to develop a new framework for Canada's passenger transportation system, one that will endure well into the 21st century.

The Royal Commission on National Passenger Transportation was established on October 19, 1989, under Part I of the *Inquiries Act*, and given three years ". . . to inquire into and report upon a national integrated intercity passenger transportation system to meet the needs of Canada and Canadians in the 21st century. . . ."

# HOW THE ROYAL COMMISSION WENT ABOUT ITS WORK

Securing a thorough understanding of the passenger transportation system as it is today is a necessary prerequisite to making recommendations for the future. To gain that understanding, the Royal Commission undertook three major initiatives: consultations, international study and research.

## CONSULTING WITH CANADIANS

Through public hearings across the country, written submissions, toll-free telephone lines, meetings and seminars, we listened to interested Canadians. These included travellers and providers of transportation infrastructure and services, as well as governments, taxpayers, unions, regulators and special interest groups such as people with disabilities and seniors. Much of what Canadians told us was reported in *Getting There*, our Interim Report.

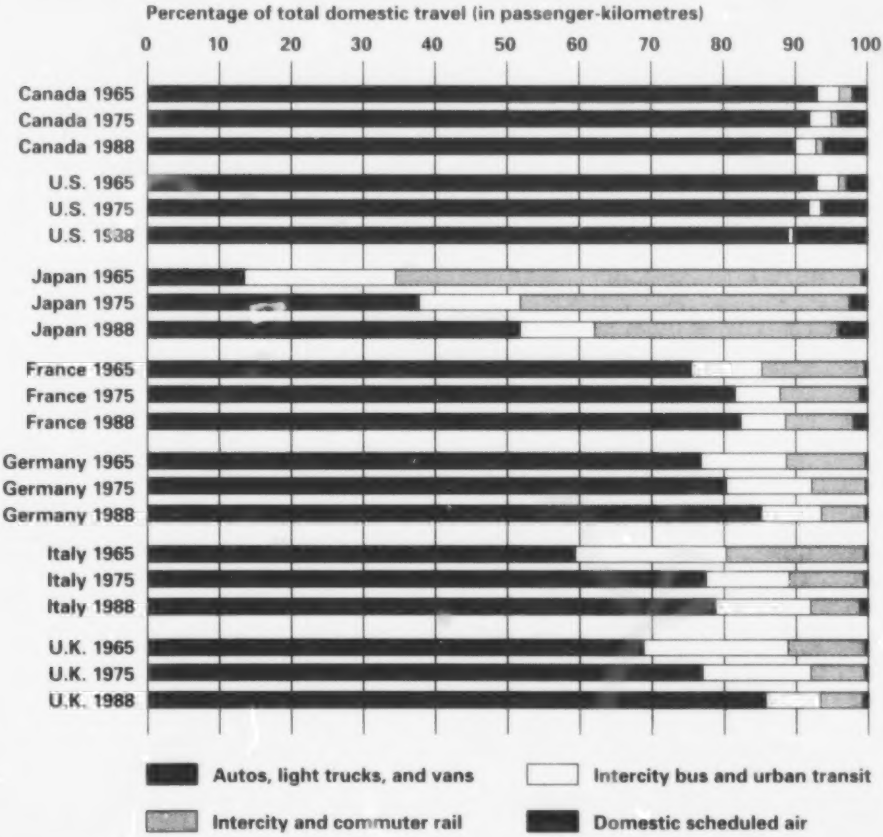
## STUDYING THE PASSENGER TRANSPORTATION SYSTEMS OF OTHER COUNTRIES

We also looked at how other countries are dealing with passenger transportation issues. We discovered that Canada is not alone in questioning the traditional ways of making passenger transportation policy and investment decisions, nor in seeking new ways to resolve transportation issues. Governments around the world are exploring ways to improve the efficiency of their transportation systems.

Canadian travel patterns are broadly similar to those of other developed countries, although there are some differences. The following chart shows that Canadians share a strong attachment to the car with travellers in other developed countries. The train is a more important passenger travel mode in Japan, and a somewhat more significant mode in Western Europe than in Canada or the United States. Most countries, however, are seeing the same long-term decrease in the importance of train and bus travel as has been observed in Canada. Airplane travel, by contrast, has increased its share of passenger travel everywhere. With their much larger land masses, Canada and the United States rely on air travel far more than Japan or Western Europe.

*Chart 1*

INTERNATIONAL COMPARISONS OF MODAL SHARES IN TOTAL DOMESTIC TRAVEL, 1965, 1975 AND 1988



**Sources:** Royal Commission staff calculations based on data from Statistics Canada, the European Conference of Ministers of Transport, and a number of U.S. and Japanese sources. For details consult the Notes to Chapter 2 in Volume 2 of the final report.

**Note:** Total domestic travel includes both urban and intercity travel.

Several countries have undertaken major transportation studies and have already begun implementing changes; others have relaxed government controls and economic regulation over their transportation carriers. Some have studied ways of setting prices that reflect the true costs of transportation services and facilities, while others have experimented with alternative transportation ownership and administrative arrangements.

## RESEARCHING PASSENGER TRANSPORTATION

Among other issues, our Research Program examined:

- travel patterns in Canada;
- the costs and who pays them;
- the effects of transportation on the environment;
- the safety of each mode; and
- accessibility for people with disabilities.

We concluded that the way the passenger transportation system in Canada is managed is no longer adequate. Why?

- most travellers do not pay the full costs of the passenger transportation services that they use, and prices do not reflect a traveller's use of the system;
- in no mode are costs entirely covered by fares, licences and fees;
- individual carriers face different rules and regulations;
- costs are higher than necessary because governments do not always invest in projects that result in the best value;
- environmental and other social costs are rarely factored into the costs of the passenger transportation system; and
- taxpayers lack information about why decisions are made and how their tax dollars are spent.

# OUR APPROACH

## OUR GUIDING PHILOSOPHY

While a passenger transportation system heavily subsidized by the taxpayer may have been appropriate for Canada for the past 125 years, it is not the right one for Canada in the 21st century. Now, and in the decades ahead, Canada needs a system supported by the travellers who use it and not by government subsidies, departments and central controls. Passenger transportation should be treated more like a business.

Instead of governments controlling who may carry passengers, we believe in a system controlled by consumers in the marketplace. Rather than governments providing most of the infrastructure, we believe the marketplace should do that job, with governments confining themselves to the roles of referee and policy maker. As a change from centralized and often remote jurisdictional arrangements, we believe transportation-related responsibilities should be moved to the level of government closest to the people that can most efficiently handle the responsibilities.

In the past, passenger transportation has depended on major funding from general taxpayers, many of whom travel only a little or not at all. We believe that the system should now be self-sustaining; travellers should get what they pay for and pay for what they get.

## OUR METHOD: A FRAMEWORK

The Royal Commission took a comprehensive approach to the passenger transportation system. We wanted to help resolve not only today's issues and problems, but those of tomorrow as well.

To accomplish this, we adopted a long-term passenger transportation framework. What do we mean by "framework"? We mean the laws, regulations and institutions that govern transportation.

Too often today, passenger transportation decisions are inconsistent, short-term and wasteful; with a guiding framework in place, future passenger transportation decisions will be coherent, consistent and less expensive after all costs paid by all parties are taken into account.

## OUR DIRECTIONS: GOAL AND OBJECTIVES OF THE TRANSPORTATION SYSTEM

As the foundation for the framework, the Royal Commission set a goal for passenger transportation and developed four objectives that we found Canadians generally support, and that we believe should guide Canada in the future. We propose Canadian solutions to Canadian problems.

We believe that the main goal of Canada's intercity passenger transportation system should be to move people to where they want to go. Travellers should be able to choose the transportation services they want, get what they pay for, and pay for what they get. They should not be encouraged to go places or travel by particular modes due to government policies or subsidies that favour particular destinations or modes.

We recommend that the passenger transportation system be guided by the following policy objectives:

(a) safety;

(b) protection of the environment;

(c) fairness to taxpayers, travellers and carriers; and

(d) efficiency, so that services are provided only where benefits to the individual traveller equal or exceed the cost, and given levels of service are provided at the lowest possible cost.
**Recommendation 4.1**

What about other possible objectives for the passenger transportation system, such as nation-building or regional development? During the Royal Commission's public hearings, some Canadians spoke about the importance of passenger transportation in nation-building and regional development. Nation-building and regional development should be objectives of the various levels of government; but should they be identified as passenger transportation objectives? We believe that the answer is no. Passenger transportation policies should not be guided by objectives of nation-building and regional development for the following reasons.

*Nation-building:* In general, the passenger transportation system is mature, and most Canadians are well served by a number of modes. We do not believe that any single transportation project, route, network or mode is likely to stand out today, as the transcontinental railway once did, as a symbol that unites Canada. We doubt that any new passenger transportation mega-project would contribute to building the nation — beyond its contribution to the nation's economy, which can be assessed using the criteria we suggest.

*Regional development:* We recognize that passenger transportation infrastructure and services can play a vital role in the development and functioning of national and regional economies. From our research and consultations, however, we concluded that separate and additional regional development benefits are unlikely to be substantial and these benefits alone should not be used to guide passenger transportation policies.

We therefore recommend that:

- Governments pursue nation-building and regional development objectives through other programs, rather than using the passenger transportation system.
  **Recommendation 4.2**

## HOW WILL OUR RECOMMENDATIONS AFFECT TRAVELLERS?

**Travellers should pay for the true costs of the travel services they use, including those for damages to the environment, and people who do not travel should not have to pay for those who do.**

Taxpayers will no longer subsidize travellers as they do under the present system.

We recommend that:

- Each traveller pay the full cost of his or her travel, and travellers, in total, pay the full cost of the passenger transportation system, including those costs related to protecting the environment, safety and accidents.
  Recommendation 4.3

Some Canadian travellers may be unhappy about our recommendations that they be charged prices and taxes at a level that covers the cost of their transportation. It should be remembered that all the costs of passenger transportation today are paid either through fares, or through taxes and income taxes. We are simply proposing that the system would be fairer to all if the burden of payment shifted from those who do not use the passenger transportation system to those who do.

**At present, taxpayers knowingly support the transportation system through direct subsidies and unknowingly, through hidden subsidies.**

Direct subsidies are those that governments show in their budgets as amounts transferred to carriers or travellers from the taxpayers. Hidden subsidies are those that are less visible to the public since they are not identified in government accounts.

Under our approach, travellers and carriers would pay the full costs of the passenger transportation system, but these costs would be based on principles of efficient investment and pricing. Travellers would not be paying for a passenger transportation system that is wasteful because it has too much or too little capacity, or capacity of the wrong type and in the wrong place. Travellers and carriers would be able to purchase services at the lowest possible prices for the greatest benefit.

Table 1 illustrates the various components of the intercity passenger transportation system.

*Table 1*
COMPONENTS OF THE TRANSPORTATION SYSTEM

| Mode | Carrier | Infrastructure | | |
|---|---|---|---|---|
| | | **Terminals** | **Links** | **Traffic control** |
| **Road** | Cars | Car parking | Roads (including bridges) | Police, road signs and signals, traffic control laws and regulations |
| | Buses | Bus terminals | | |
| **Air** | Airplanes | Airports (including runways) | Air navigation systems | Air traffic control |
| **Rail** | Trains | Stations | Railway tracks | Dispatch, signal systems |
| **Water** | Ferries | Ferry terminals (including wharves and ferry slips) | Waterways and canals (including navigational aids) | Vessel traffic services |

Tables 2(a) and 2(b) illustrate the comprehensive system-wide costs of intercity domestic travel and who pays these costs today. Under "users," the tables show estimates of costs paid by travellers and costs paid by carriers that will be passed on to travellers.

Under "others," the tables show costs that are not borne by travellers. For the most part, these are costs borne by general taxpayers, and also include estimates of environmental damage that is now borne by the public. Costs borne by others represent an overall measure of subsidies to travellers.

Table 2(a)

### ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL, PAID BY USERS AND OTHERS, 1991, IN 1991 DOLLARS

| Average costs: cents per passenger-kilometre | | | | | | |
|---|---|---|---|---|---|---|
| | Car | | | Bus | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 2.1 | 2.1 | 0.0 | 0.3 | 0.3 |
| **Environmental** | 0.0 | 0.6 | 0.6 | 0.0 | 0.2 | 0.2 |
| **Accident** | 3.7 | 0.1 | 3.8 | 0.4 | 0.0 | 0.4 |
| **Special trans. tax/fee** | 1.2 | –1.2 | 0.0 | 0.3 | –0.3 | 0.0 |
| **Vehicle/Carrier** | 10.9 | 0.0 | 10.9 | 8.4 | 0.2 | 8.6 |
| **Total** | **15.8** | **1.6** | **17.4** | **9.1** | **0.4** | **9.5** |
| | Airplane | | | Train | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 2.2 | 3.4 | 5.6 | 2.9 | 0.0 | 2.9 |
| **Environmental** | 0.0 | 1.0 | 1.0 | 0.0 | 0.6 | 0.6 |
| **Accident** | 0.1 | 0.0 | 0.1 | 0.2 | 0.0 | 0.2 |
| **Special trans. tax/fee** | 0.6 | –0.6 | 0.0 | 0.4 | –0.4 | 0.0 |
| **Vehicle/Carrier** | 14.4 | 0.1 | 14.4 | 7.4 | 32.8 | 40.2 |
| **Total** | **17.3** | **3.8** | **21.1** | **10.9** | **33.0** | **43.9** |
| | Ferry | | | All intercity travel | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 4.7 | 4.7 | **0.2** | **2.2** | **2.4** |
| **Environmental** | 0.0 | 2.0 | 2.0 | **0.0** | **0.6** | **0.6** |
| **Accident** | 0.1 | 0.0 | 0.1 | **3.3** | **0.2** | **3.4** |
| **Special trans. tax/fee** | 0.9 | –0.9 | 0.0 | **1.1** | **–1.1** | **0.0** |
| **Vehicle/Carrier** | 24.1 | 11.6 | 35.7 | **11.2** | **0.2** | **11.4** |
| **Total** | **25.1** | **17.4** | **42.5** | **15.8** | **2.0** | **17.8** |

*Table 2(b)*

## Illustrative System-Wide Annual Costs of Intercity Domestic Travel, Paid by Users and Others, 1991, in 1991 Dollars

| Totals: $ millions | | | | | | |
|---|---|---|---|---|---|---|
| | Car (210 billion pass-km) | | | Bus (3.3 billion pass-km) | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0 | 4,486 | 4,486 | 0 | 10 | 10 |
| **Environmental** | 0 | 1,211 | 1,211 | 0 | 8 | 8 |
| **Accident** | 7,874 | 172 | 8,046 | 13 | 0 | 13 |
| **Special trans. tax/fee** | 2,461 | −2,461 | 0 | 9 | −9 | 0 |
| **Vehicle/Carrier** | 22,817 | 0 | 22,817 | 277 | 8 | 285 |
| **Total** | **33,152** | **3,408** | **36,560** | **299** | **17** | **316** |
| | Airplane (25 billion pass-km) | | | Train (1.4 billion pass-km) | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 556 | 845 | 1,401 | 41 | 0 | 41 |
| **Environmental** | 0 | 247 | 247 | 0 | 9 | 9 |
| **Accident** | 25 | 0 | 25 | 3 | 0 | 3 |
| **Special trans. tax/fee** | 149 | −149 | 0 | 6 | −6 | 0 |
| **Vehicle/Carrier** | 3,595 | 0 | 3,595 | 104 | 459 | 563 |
| **Total** | **4,325** | **943** | **5,268** | **154** | **462** | **616** |
| | Ferry (0.85 billion pass-km) | | | All intercity travel (240 billion pass-km) | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0 | 40 | 40 | **597** | **5,381** | **5,978** |
| **Environmental** | 0 | 17 | 17 | **0** | **1,492** | **1,492** |
| **Accident** | 1 | 0 | 1 | **7,916** | **172** | **8,088** |
| **Special trans. tax/fee** | 7 | −7 | 0 | **2,632** | **−2,632** | **0** |
| **Vehicle/Carrier** | 205 | 98 | 303 | **26,998** | **565** | **27,563** |
| **Total** | **213** | **148** | **361** | **38,143** | **4,978** | **43,121** |

**Note:** **In order to illustrate smaller components, averages are shown to the nearest tenth of a cent and totals to the nearest million dollars. In general, cost estimates are approximate and are not accurate to this level of precision.**

The tables show that bus travel is the least costly mode, with an average total cost of 9.5¢ per passenger-kilometre. We estimate that bus travellers pay all but 0.4¢ per passenger-kilometre of this. Car and airplane travellers receive a somewhat larger subsidy; the general taxpayer and the public subsidize car travel by an estimated 1.8¢ per passenger-kilometre and air travel by 3.6¢ per passenger-kilometre. These subsidies cover infrastructure, environmental and accident costs not paid by users, plus small direct subsidies paid for air travel in some provinces, and are net of special taxes collected by federal or provincial governments.

The largest gap between "users" and "total" costs are for train travel (33.0¢ per passenger-kilometre) and ferry travel (17.4¢ per passenger-kilometre). This is due to large, direct subsidies from the taxpayers to travellers using passenger rail and some ferry services. For the interpretation of these tables, see *Directions*, Volume 1, Chapter 3.

Our recommendation that travellers pay the full costs of their travel means that travellers using a public mode of transportation such as the bus, train, commercial airplane or ferry, as well as those travelling by private car or private airplane, will pay fares, taxes or fees sufficient to cover their share of the full cost of providing services they use. The recommendation also means that the burden on the general taxpayer would be reduced accordingly.

In paying the full costs, travellers should also pay, through either a portion of their fare, a tax or a charge, for any environmental damage they cause and for all safety and accident costs associated with their travel.

Environmental damage charges are addressed in **Recommendation 7.4** and **Recommendation 7.5** and include, among other things, the costs of clean-up and mitigation, and the administration of environmental policies and regulations. **Recommendation 7.6** stipulates that the charges be applied equally to all modes.

For more information on the environment, and the complete text of Recommendations 7.1 to 7.7, see *Directions*, Volume 1, Chapter 7.

Charges for safety and accident costs will include the cost of safety services provided by governments, and health care costs currently borne by the health insurance system.
**Recommendation 8.1**

For more on safety and the complete text of Recommendations 8.1 and 8.2, see *Directions*, Volume 1, Chapter 8.

## ACCESS FOR PEOPLE WITH DISABILITIES

Nearly 10 percent of Canada's adult population has a transportation-related disability. The following table provides an estimate of the number of Canadians with transportation-relevant disabilities by type of disability.

*Table 3*
*NUMBER OF PERSONS WITH TRANSPORTATION-RELEVANT DISABILITIES, BY TYPE OF DISABILITY, 1990*

| | Number | Percent[a] |
|---|---|---|
| **All Canadians aged 15 and over with transportation-relevant disabilities** | 1,879,615 | 100.0 |
| Mental disability | 714,398 | 38.0 |
| Hearing impairment | 648,780 | 34.5 |
| Sight impairment | 417,990 | 22.2 |
| Speech impairment | 159,843 | 8.5 |
| Wheelchair or walker use | 132,660 | 7.1 |
| Blindness | 42,176 | 2.2 |
| Disability unspecified | 37,052 | 2.0 |

**Sources: Hickling Corporation, using data from Statistics Canada's Health and Activity Limitation Survey, 1987, with projections to 1990; *Transportation for People with Disabilities: A Policy Review and Analysis*, a report prepared for the Royal Commission on National Passenger Transportation, RR-01, March 1991, p. 5.**

**a. Figures will add to more than 100 percent because some people have multiple disabilities. Figures include people living in institutions but exclude those confined to the home (an estimated 37,600).**

## People with disabilities should have wider access to the passenger transportation system

While the Royal Commission acknowledges that governments and industry have taken important steps to provide access to intercity passenger transportation services for people with disabilities, our approach goes further. We recommend that:

- Travellers with physical or mental disabilities have opportunities similar to those enjoyed by all Canadians to use public passenger transportation.
  **Recommendation 4.4**

We further recommend that:

- Governments establish a goal that all travellers in Canada have access to public transportation in a safe, reasonably comfortable and dignified fashion, irrespective of physical or mental ability.
  **Recommendation 9.1**

For carriers and providers of infrastructure, we recommend: that they begin immediately to ensure that their specifications for new equipment and infrastructure provide continuing improvements in accessibility; that carriers cover an attendant's fare if they decide that, for safety reasons, an attendant is needed during a trip; and that they ensure that any personnel who might be required to assist travellers with disabilities are trained to deal with such travellers with sensitivity and understanding.
**Recommendations 9.3, 9.8 and 9.9**

We also recommend an expanded role for the National Transportation Agency (NTA) regarding people with disabilities, more specifically: that the NTA establish minimum standards of passenger accessibility; that it take more active responsibility for ensuring that transportation

services become more accessible to people with disabilities; and that the NTA be appointed the referee to mediate disputes regarding the need for an attendant.
**Recommendations 9.2, 9.4 and 9.7**

We further recommend that:

- Through consultation among groups representing people with disabilities, carrier associations and the National Transportation Agency, a mechanism such as a coded identification card system be devised that would indicate quickly to carrier personnel the kinds of services needed by each traveller with a disability, including whether or not the traveller requires an attendant for safety or other reasons.
  **Recommendation 9.6**

For more information on access to transportation for people with disabilities and the complete text of Recommendations 9.1 to 9.11, see *Directions*, Volume 1, Chapter 9.

## HOW WILL OUR RECOMMENDATIONS AFFECT CARRIERS?

**Passenger transportation carriers should face market pressures to respond to consumer preferences and to reduce costs, to improve efficiency, and to pass resulting savings on to travellers.**

### Canadian passenger transportation and the marketplace

We recommend that:

- Competition and market forces be the prime agents in providing viable and efficient carrier services.
  **Recommendation 4.5**

To achieve this marketplace discipline, governments will make it easier for new competitors to enter the market by eliminating or easing restrictions. All competitors that meet "fit, willing and able" criteria will have the opportunity to supply passenger carrier services. Moreover, these potential new entrants will have equal access to transportation infrastructure so long as they are prepared to pay their share of the costs. And, as we said before, these costs include those imposed by travellers through environmental damage, safety costs and accidents. At the same time, anyone providing passenger transportation services will be able to withdraw these services without undue delay, subject only to adequate notice.

We therefore recommend that:

- Federal, provincial and territorial governments amend their legislation concerning the regulation of intercity buses to reduce entry restrictions to "fit, willing and able" criteria, and require only public notice of route abandonments and publication of schedules and fares.
  **Recommendation 13.1**

- The federal government invite Canadian air carriers to make public proposals for future international air route designations, with the air carrier offering the best package to be granted the route and the reasons made public, and Canadian air carriers be allowed to sell designated international routes to one another.
  **Recommendations 11.3 and 11.4**

- Governments abstain from making any financial contribution that is intended to ensure the survival of air carriers.
  **Recommendation 11.5**

- The federal government amend legislation to make rail track access available to all qualified passenger carriers who are willing to pay for what they use and ensure that all such carriers have a right of access to essential infrastructure and are treated equally in the movement of traffic.
  **Recommendation 6.7**

- Airport and municipal authorities cooperate to ensure unrestricted access to airports by all ground connectors who pay their share of the costs, and the federal government similarly grant all ground connectors open access to federally owned airports and rail stations.
  **Recommendation 15.1**

- The federal government require that all agreements for the sale or lease of federally owned transportation infrastructure include provisions that oblige the operating authority to grant open access to all intermodal connectors on equal terms and conditions.
  **Recommendation 15.2**

**An exception to the rule . . .**

Under current international arrangements, if a Canadian airline is no longer owned and controlled by Canadians, its classification as a "national airline" is jeopardized; this, in turn, may put the airline's entitlement to fly international routes at risk.

Although the Royal Commission recommends no restrictions on ownership of the other modes, we make an exception for air carriers because of this current international regulatory regime.

Regarding ownership of airlines, we recommend that:

- The federal government and the government of Alberta amend their legislation to eliminate the 10 percent ceiling on individual holdings that currently applies to Air Canada and Pacific Western Airlines (the parent of Canadian Airlines International).
  **Recommendation 11.2**

- The federal government retain the existing limits on foreign ownership and control of air carriers.
  **Recommendation 11.1**

- If faced with a potential reduction to only one major Canadian carrier in the domestic market, the federal government use its powers to override limitations on foreign ownership and control for the explicit purpose of, and to the extent required to, ensure competition in the domestic market.
  **Recommendation 11.6**

For more on "ownership" in the air mode, see *Directions*, Volume 1, Chapter 11.

## HOW WILL OUR RECOMMENDATIONS AFFECT PROVIDERS OF INFRASTRUCTURE?

**Suppliers of transportation infrastructure should charge for their services. Those who do not benefit from these services should not have to pay for them.**

Carriers and travellers told us that if they are going to be asked to pay the full cost for terminals such as airports, links such as roads and railway tracks, as well as traffic control services, they want to be sure that what is provided is only what is needed, no more, no less. The Royal Commission agrees and recommends that:

- Terminals, links and traffic control services be priced on a terminal-by-terminal, link-by-link and service-by-service basis.
  **Recommendation 4.6**

- Where there is sufficient competition, or where users are in a strong bargaining position with providers of terminals, links or traffic control services — and so long as there are appropriate charges for environmental damage, safety and accidents — competition and market forces determine prices and investment decisions for passenger transportation infrastructure.
  **Recommendation 4.7**

- Where regulations are required, they be designed to ensure that pricing and investment decisions will be similar to what would otherwise occur through competitive market forces.
**Recommendation 4.8**

## SETTING PRICES

**Travellers should only pay for what they use.**

Prices will reflect the travellers' or carriers' use of each terminal, link or traffic control service and will be designed to encourage neither overuse nor underuse.

And, where the prices do not recover the full cost of providing the service, they will be adjusted to provide for full cost recovery in such a way as to minimize the loss of efficiency.

We therefore recommend that:

- Conventional tolling systems be considered when new or expanded, limited-access highways are required, with tolls set to cover any costs of the road link in question exceeding those recovered by fuel taxes.
**Recommendation 5.6**
- Provincial and territorial governments institute weight-distance taxes for trucks as part of an overall road-financing program.
**Recommendation 5.5**
- Airport operators obtain their funding from site-specific charges on an airport-by-airport basis, rather than through an allocation from the Air Transportation Tax. Charges to travellers will reflect the commercial potential of the airport, not historical costs.
**Recommendations 5.1 and 5.3**
- The operator of the air navigation system obtain funding for that system by charging aircraft operators directly for their share of air navigation and air traffic control costs by using charges that differ

by type of flight, class of aircraft and value of benefits received, rather than an allocation from the Air Transportation Tax. This system would replace the Air Transportation Tax.
**Recommendation 5.7**

A decision to move to a link-by-link charge for the existing road system will be based, in part, on technological feasibility, administrative cost and public acceptability.

For road projects, we therefore recommend that:

- Provincial and territorial governments meet the costs of their highway system, and any agreed upon National Highway System projects within their borders, through fuel taxes and other charges.
**Recommendation 6.6**

For more on investment and pricing and the complete text of Recommendations 5.1 to 5.7, see *Directions*, Volume 1, chapters 5 and 6.

## INVESTING IN TRANSPORTATION

**Regardless of mode, investments will be made only in those passenger transportation projects in which benefits to travellers exceed costs, and in those that yield the highest level of benefits over costs.**

We therefore recommend that:

- For transferring airports to Local Airport Authorities, the federal government's valuation of existing airport capital facilities reflect the commercial potential of the facilities, not historical costs.
**Recommendation 5.3**
- Governments or local airport authorities make airport investments on an airport-by-airport basis and only make new airport investments where costs, including a return on investment, can be expected to be repaid through future revenues.
**Recommendations 5.1 and 5.3**

- In determining the extent of restoration and upgrading required for the national highway network, provincial and territorial governments be guided by a comparison of benefits and costs on individual projects, rather than by uniform engineering standards.
  **Recommendation 6.4**
- Governments invest in high-speed rail infrastructure only if the benefits to the passenger transportation system exceed the costs, and if taxpayers do not have to pay any operating subsidies.
  **Recommendation 12.6**
- Any railway company be allowed to abandon any amount of track without a limit.
  **Recommendation 6.8**
- All responsible agencies, in evaluating safety improvements in different modes, use comparable values for injury and loss of life.
  **Recommendation 8.2**

## HOW WILL OUR RECOMMENDATIONS AFFECT GOVERNMENT?

**Transportation should be moved out of the government tax-and-spend regime into one that is supported and maintained by the users of the system.**

We have said that competition and market forces should be the prime agents in developing a viable and efficient passenger transportation system. There are some functions in the passenger transportation system, however, that can and should only be performed by governments.

- Governments will be responsible for establishing policies in relation to the passenger transportation framework, setting and enforcing standards, gathering and reporting information to the public, ensuring a sufficient level of research, maintaining competition and regulating monopolies.
  **Recommendation 4.9**

Federal, provincial and territorial transportation departments should move toward being small policy-oriented departments. The departments should shed most or all of their operating responsibilities. Government agencies might still be used to provide some carrier services and operate some infrastructure. They will, however, be expected to function without subsidies, and private sector firms will, in general, be free to enter the market in competition with such government operators.

Therefore, we recommend that:

- The federal government transfer all remaining airports to Local Airport Authorities and/or to other types of local operators, and convert the air navigation system from a departmental organization to either a Crown corporation or an independent institution.
  **Recommendations 6.1 and 6.2**
- Each provincial and territorial government establish a Crown corporation, supplemented by an advisory group, to be responsible for providing roads more efficiently and making pricing and investment decisions more transparent.
  **Recommendation 6.3**
- Railway companies offer abandoned rail rights-of-way, under a formal procedure, to governments and then to other railway companies before such rights-of-way can be converted to other uses. All levels of government develop policies, based on explicit criteria, for deciding which corridors they wish to retain for future transportation use and ensure that land so acquired is maintained intact as a corridor.
  **Recommendation 6.9**

We recommend that the federal government:

- Review the *Competition Act* and related policy and, if required, strengthen the powers needed to prevent anti-competitive practices in the intercity bus industry.
  **Recommendation 13.2**

- Extend its regulations governing the anti-competitive practices of computer reservation systems beyond the air mode to take a multimodal approach.
  **Recommendation 15.3**

- Establish the regulations under which any high-speed rail system will operate, including safety and environmental regulations.
  **Recommendation 12.8**

We recommend that the National Transportation Agency:

- Ensure that abandoned railway corridors are offered to governments or other railway companies at a reasonable price.
  **Recommendation 6.9**

We recommend that provincial and territorial governments:

- Implement more-uniform and adequate minimum accessibility standards for intercity buses for travellers with disabilities, or, if that does not occur, the federal government rescind its delegated responsibility for nationally applied accessibility standards in order to ensure more uniformity.
  **Recommendation 9.10**

We also recommend that all governments:

- Further develop travel and transportation data for public use, and the federal government publish an annual report card on the passenger transportation system.
  **Recommendations 16.2, 16.3 and 16.4**

We recognize that the policies of one level of government regarding a mode for which it is responsible can affect other modes that are the responsibility of another level of government. But, as long as all modes are paying their way, as we recommend, this type of interaction is not inherently a problem.

Therefore, we recommend that:

- Decision-making authority of governments be assigned to the level of government that is both closest to the people and most able to efficiently exercise such authority.
  **Recommendation 4.10**

We also believe that our framework can be implemented using a cooperative approach within existing jurisdictional arrangements.

We therefore recommend that:

- A National Highway System be identified by the Council of Ministers Responsible for Transportation and Highway Safety and be operated and maintained through cooperative action of provincial and territorial governments and/or their road agencies.
  **Recommendation 6.5**
- Local or regional governments take policy responsibility for controlling environmental damage when the source and effects are local.
  **Recommendation 7.1**
- The federal government take responsibility when environmental damage from one region affects other regions or countries; continue to strive for development of an effective international strategy to control global warming; and seek to harmonize domestic policies and taxes with the international community.
  **Recommendation 7.2**

## All modes will be treated equally

We recommend that:

- Governments tax and regulate all modes equally.
  **Recommendation 4.11**

- All fuel taxes be used for transportation purposes or as a means of charging for costs, such as environmental damage and health care system costs, caused by transportation.
  **Recommendation 5.4**

- Governments apply environmental emission charges equally to all modes and to non-transportation sources, on as close to a per-unit-of-emission basis as practical.
  **Recommendation 7.6**

- Governments set regulations for the control of environmentally damaging emissions. These regulations should impose similar obligations in terms of cost per unit of abatement on each mode, and treat non-transportation sources of pollutants similarly to transportation sources.
  **Recommendation 7.3**

- Governments separate revenues from environmental emission charges from other passenger transportation revenues and use such funds to clean up the environmental damage, compensate those affected, or lower general tax rates. They should not use such funds to expand or maintain the passenger transportation system.
  **Recommendation 7.7**

## IMPROVING ACCOUNTABILITY AND TRANSPARENCY

**The costs of the transportation system should be transparent, and governments should be accountable for their decisions.**

Passenger transportation decisions made by governments should be clear, obvious and direct, and all costs should be made public. We therefore recommend that:

- Decision making be transparent so that Canadians can understand why governments or their agencies make the passenger transportation choices they make, and so that those making decisions can be held accountable.
  **Recommendation 4.12**

To achieve this transparency in the decision-making process, we further recommend that:

- If agencies that are established to manage transportation infrastructure are monopoly suppliers, the level of government responsible ensure that advisory bodies of travellers and other interested parties are created to counsel management on investment priorities, charging mechanisms and the prices needed to achieve self-sufficiency.
  **Recommendation 16.1**
- Governments clearly report to the public the amount of, and reason for, any continuing subsidies to carriers.
  **Recommendations 12.5, 14.4 and 16.4**
- The federal government allocate resources, and provincial and territorial governments cooperate with the federal government, to ensure the further improvement and collection of travel and other transportation data, and that the data be made available to the public.
  **Recommendations 16.2 and 16.3**
- The federal government publish an annual report card on the passenger transportation system that will include information on the use of the system, subsidies, extent of cost recovery, and degree to which objectives are being met, as well as information on the reliability and safety of transportation.
  **Recommendation 16.4**

## GIVING THE PASSENGER TRANSPORTATION SYSTEM TIME TO ADJUST

We recognize that our proposed transportation framework will differ substantially from the current system and that governments will have to give travellers, carriers and infrastructure providers time to adjust.

We therefore recommend that:

- In cases where time is required to ease the problems caused by steep price adjustments, or where a carrier, a particular carrier service, a terminal or a link is to be given another chance to survive within the new framework, financial assistance be designed to encourage adjustment.
  **Recommendation 4.13**
- If a carrier, a particular carrier service, a terminal or a link cannot survive despite a reasonable period of time for adjustment, the terminal or link be closed or the service discontinued.
  **Recommendation 4.14**

During the adjustment period, any remaining subsidy from the taxpayer be:

- provided, where possible, to move people in the most efficient way, regardless of mode;
- borne by taxpayers in the jurisdiction that makes the decision, not by other transportation users; and
- provided on a declining basis, for a reasonable adjustment period, and then terminated.
  **Recommendation 4.13**

The Royal Commission recognizes four cases in which governments may have to provide transitional subsidies: airports, passenger rail, intercity bus and ferries. We therefore recommend that:

- Whenever applying our principles to airports, including all Transport Canada airports, would result in steep increases in average charges to travellers, governments provide transitional subsidies to be phased out over 10 years. The initial level of subsidy should be based on the current operating subsidy and be used for capital as well as operating expenditures or, if the airport is closed, for other local transportation purposes.
  **Recommendation 5.2**

- The federal government enact legislation to give VIA Rail a mandate to operate on a commercial basis, with the general subsidy having a sunset provision of 10 years. During this period, VIA Rail will have greater freedom to manage, including investment decisions, route selection, service levels and pricing; will be allowed to compete for other services such as commuter services and transporting mail; and will be required to file and publish detailed annual operating plans and financial reports, including the costs and revenues related to individual routes. At the end of 10 years, all routes, excluding remote services, should be unsubsidized.
  **Recommendations 12.1, 12.2, and 12.3**

- If necessary to avoid steep increases in bus fares on particular routes following the relaxation of economic regulation of the bus industry, governments provide transitional subsidies on a declining basis not to exceed 10 years.
  **Recommendation 13.3**

- If necessary to avoid steep increases in fares, governments provide transitional subsidies not to exceed 10 years on individual ferry routes.
  **Recommendation 14.1**

In some cases, governments might choose to continue subsidies to passenger transportation services that are not commercially viable. Such subsidies are not consistent with our framework and, in general, should not be maintained. If, however, governments continue to provide subsidies despite our recommendations, they should do so in such a way as to ensure that services provided are as efficient as possible. In addition, such subsidies should be provided from general tax revenues and not from charges to travellers.

Where governments judge that a subsidy for passenger transportation to remote communities is justified, we recommend that:

(a) the most efficient mode and carrier be used and, where feasible, a competitive bidding process be implemented;

(b) any subsidized remote access service (regardless of mode) be designed to take passengers out to, and bring them in from, the closest convenient point where transfer can be made to a commercial unsubsidized carrier; and

(c) subsidies and their purpose be open to public scrutiny. **Recommendation 12.5**

In the case of constitutionally provided ferry services, we recommend that:

- The federal government strive for the highest degree of cost-recovery, consistent with its constitutional obligations, or offer the affected province a grant instead of a subsidy. **Recommendation 14.2**

## THE SYSTEM COSTS

We have discussed the changes that our recommendations will bring to travellers, carriers, providers of transportation infrastructure and governments.

Since a large part of these discussions focussed on changes in costs and charges, it is important for us to talk about the general costs of the passenger transportation system today and what they will be in the future, after our recommendations are implemented.

We have demonstrated what the costs of the system are today in Tables 2(a) and 2(b), "Illustrative system-wide annual costs of inter-city domestic travel, paid by users and others, 1991, in 1991 dollars." These tables are interpreted in *Directions*, Volume 1, Chapter 3.

Chapter 18 of *Directions*, Volume 1 picks up the discussion and illustrates, by the use of tables and charts, how these estimated costs might evolve if the status quo were maintained, and how they will change after the implementation of our recommendations. Tables 4, 5 and 6 reproduce some of this information.

*Table 4*

## ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL IN 2000 "STATUS QUO"

Totals: $ millions, in 1991 dollars

| Type of cost | Car<br>(270 billion pass-km) | | | Bus<br>(3.3 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 5,769 | 5,769 | 0 | 10 | 10 |
| Environmental | 0 | 1,247 | 1,247 | 0 | 8 | 8 |
| Accident | 9,213 | 202 | 9,415 | 12 | 0 | 12 |
| Special trans. tax/fee | 3,199 | −3,199 | 0 | 9 | −9 | 0 |
| Vehicle/Carrier | 28,954 | 0 | 28,954 | 277 | 8 | 285 |
| **Total** | **41,366** | **4,019** | **45,385** | **298** | **17** | **315** |
| **Type of cost** | **Airplane<br>(33 billion pass-km)** | | | **Train<br>(1.4 billion pass-km)** | | |
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 723 | 701 | 1,424 | 45 | 0 | 45 |
| Environmental | 0 | 266 | 266 | 0 | 9 | 9 |
| Accident | 33 | 0 | 33 | 3 | 0 | 3 |
| Special trans. tax/fee | 165 | −165 | 0 | 6 | −6 | 0 |
| Vehicle/Carrier | 4,127 | 0 | 4,127 | 99 | 435 | 534 |
| **Total** | **5,048** | **802** | **5,850** | **153** | **438** | **591** |
| **Type of cost** | **Ferry<br>(1.1 billion pass-km)** | | | **All intercity travel<br>(310 billion pass-km)** | | |
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 52 | 52 | 768 | 6,532 | 7,300 |
| Environmental | 0 | 22 | 22 | 0 | 1,552 | 1,552 |
| Accident | 1 | 0 | 1 | 9,262 | 202 | 9,464 |
| Special trans. tax/fee | 10 | −10 | 0 | 3,389 | −3,389 | 0 |
| Vehicle/Carrier | 264 | 113 | 377 | 33,721 | 556 | 34,277 |
| **Total** | **275** | **177** | **452** | **47,140** | **5,453** | **52,593** |

**Note: In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision.**

### Table 5

## Illustrative System-Wide Annual Costs of Intercity Domestic Travel in 2000 "Directions"

**Totals: $ millions, in 1991 dollars**

| Type of cost | Car (270 billion pass-km) | | | Bus (3.3 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 5,491 | 0 | 5,491 | 9 | 0 | 9 |
| Environmental | 1,122 | 0 | 1,122 | 6 | 0 | 6 |
| Accident | 9,414 | 0 | 9,414 | 12 | 0 | 12 |
| Special trans. tax/fee | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 28,480 | 0 | 28,480 | 237 | 5 | 242 |
| **Total** | **44,507** | **0** | **44,507** | **264** | **5** | **269** |

| Type of cost | Airplane (33 billion pass-km) | | | Train (0.7 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 1,133 | 40 | 1,173 | 32 | 0 | 32 |
| Environmental | 253 | 0 | 253 | 4 | 0 | 4 |
| Accident | 33 | 0 | 33 | 1 | 0 | 1 |
| Special trans. tax/fee | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 4,127 | 0 | 4,127 | 181 | 60 | 241 |
| **Total** | **5,546** | **40** | **5,586** | **218** | **60** | **278** |

| Type of cost | Ferry (1.1 billion pass-km) | | | All intercity travel (310 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 47 | 0 | 47 | 6,725 | 40 | 6,765 |
| Environmental | 17 | 0 | 17 | 1,405 | 0 | 1,405 |
| Accident | 1 | 0 | 1 | 9,470 | 0 | 9,470 |
| Special trans. tax/fee | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 320 | 28 | 348 | 33,411 | 93 | 33,504 |
| **Total** | **385** | **28** | **413** | **51,011** | **133** | **51,144** |

Note: In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision.

Costs for means of travel do not sum to costs for all intercity travel, as the latter also includes allowance for costs of increased car, bus and airplane travel to replace assumed reduction in rail travel between 2000 S-Q and 2000 D cases.

Table 6

## ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL, CHANGES BROUGHT BY IMPLEMENTING "DIRECTIONS" COMPARED WITH THE "STATUS QUO"

Totals: $ millions, in 1991 dollars

| Type of cost | Car | | | Bus | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 5,491 | -5,769 | -278 | 9 | -10 | -1 |
| Environmental | 1,122 | -1,247 | -125 | 6 | -8 | -2 |
| Accident | 201 | -202 | -1 | 0 | 0 | 0 |
| Special trans. tax/fee | -3,199 | 3,199 | 0 | -9 | 9 | 0 |
| Vehicle/Carrier | -474 | 0 | -474 | -40 | -3 | -43 |
| **Total** | **3,141** | **-4,019** | **-878** | **-34** | **-12** | **-46** |

| Type of cost | Airplane | | | Train | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 410 | -661 | -251 | -13 | 0 | -13 |
| Environmental | 253 | -266 | -13 | 4 | -9 | -5 |
| Accident | 0 | 0 | 0 | -2 | 0 | -2 |
| Special trans. tax/fee | -165 | 165 | 0 | -6 | 6 | 0 |
| Vehicle/Carrier | 0 | 0 | 0 | 82 | -375 | -293 |
| **Total** | **498** | **-762** | **-264** | **65** | **-378** | **-313** |

| Type of cost | Ferry | | | All intercity travel | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 47 | -52 | -5 | 5,957 | -6,492 | -535 |
| Environmental | 17 | -22 | -5 | 1,405 | -1,552 | -147 |
| Accident | 0 | 0 | 0 | 208 | -202 | 6 |
| Special trans. tax/fee | -10 | 10 | 0 | -3,389 | 3,389 | 0 |
| Vehicle/Carrier | 56 | -85 | -29 | -310 | -463 | -773 |
| **Total** | **110** | **-149** | **-39** | **3,871** | **-5,320** | **-1,449** |

**Note:** In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision.

Costs for means of travel do not sum to costs for all intercity travel, as the latter also includes allowance for costs of increased car, bus and airplane travel to replace assumed reduction in rail travel between 2000 S-Q and 2000 D cases.

Therefore, with our recommendations in place, there will be not only a transfer of costs from taxpayers to travellers, but also annual savings for both in most types of passenger transportation costs:

| | |
|---|---|
| • savings to general taxpayers and general public | $5.320 billion |
| • increased costs to travellers | $3.871 billion |
| • savings in total costs of passenger travel | $1.449 billion |

## MEETING OUR PASSENGER TRANSPORTATION OBJECTIVES

We believe that our recommendations will meet our objectives and create a passenger transportation system that is safe, that is more protective of the environment, that ensures fairness to taxpayers, travellers and carriers and that operates more efficiently.

### Objective 1: Improving safety

We are convinced that when travellers and carriers face the full costs of accidents and safety programs, they will change their behaviour and reduce accidents. We also expect that the discipline involved in objectively assessing risks, evaluating safety measures, and providing accountability and transparency in setting charges will encourage governments to treat the modes with greater consistency, thereby getting the most safety improvement per dollar spent.

### Objective 2: Greater protection of the environment

We believe that our recommendations will lead to a greater protection of the environment by persuading users to reduce the amount of damage they cause and by ensuring that those who travel less will not pay the environmental costs imposed by those who travel more. All of the modes will be subject to the same regulatory standards and charges.

While our recommendations call for radical change, we believe they are rational, fair and will achieve national environmental goals efficiently and at a lower overall cost.

### Objective 3: Greater fairness to taxpayers, travellers and carriers

We believe that subsidies from taxpayers and some transportation users to certain groups are unfair; for example, air travellers being supported by non-travellers for the costs of air navigation systems and airport expenses or train travellers being supported by direct subsidies from taxpayers for their ticket. Such subsidies to one mode are unfair to other modes that could offer competing services.

The remedy is straightforward. Under our framework, carriers, and ultimately travellers, will pay all the costs of transportation infrastructure and services. This remedy will also apply to those modes that receive large subsidies — the passenger rail services and ferry services for which there are no constitutional obligations.

### Objective 4: A more efficient transportation system

The passenger transportation system will be made more efficient, delivering better service at lower costs, through reforms in ownership, management, pricing policies and investments.

We are convinced that competition will spur innovation: competition among modes, among carriers within modes and, where relevant, among providers of infrastructure.

## REACHING OUR DESTINATION

Our principles will ensure a framework in which costs are reflected in prices paid by travellers, and in which institutions are flexible and responsive. This framework will constrain transportation activities that become too costly relative to benefits provided, and will encourage the transportation industry to take advantage of new opportunities resulting from improved technology and other favourable developments.

This summary is only a glimpse of our findings and recommendations and we encourage you to consult *Directions*, our final report. We believe that an understanding of how the current passenger transportation system operates, how it is financed, who pays for the services and who owns and manages the system, will convince you that it is time for change.

# DIRECTIONS

## LE RAPPORT FINAL DE LA COMMISSION ROYALE SUR LE TRANSPORT DES VOYAGEURS AU CANADA

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# DIRECTIONS

# LE RAPPORT FINAL DE LA COMMISSION ROYALE SUR LE TRANSPORT DES VOYAGEURS AU CANADA

## RÉSUMÉ

La Commission royale sur le transport des voyageurs au Canada sait que le transport touche la vie de chacun et qu'il importe que le plus grand nombre de Canadiens soient renseignés sur nos recommandations visant le système canadien de transport des voyageurs au XXI$^{e}$ siècle.

C'est pourquoi la Commission royale a choisi de publier un résumé de son rapport final, Directions. Celui-ci donne un bref aperçu de nos principales conclusions et recommandations et nous espérons qu'il convaincra le lecteur de l'intérêt de prendre connaissance du tableau d'ensemble en lisant le rapport final.

*Directions, le Rapport final de la Commission royale sur le transport des voyageurs au Canada,* publié en quatre volumes, est disponible dans les bibliothèques municipales. Ceux et celles que cela intéresse peuvent également l'acheter directement auprès de Groupe Communication Canada — Édition, Approvisionnements et Services Canada et d'autres librairies. Pour savoir comment vous procurer le jeu complet en quatre volumes de *Directions,* ou seulement les volumes 1 et 2 (Conclusions et recommandations et documentation d'appui), vous êtes priés d'appeler le (819) 956-4802.

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# CE QUE LE GOUVERNEMENT DU CANADA AVAIT DEMANDÉ À LA COMMISSION ROYALE DE FAIRE

Partout dans le monde, le transport subit de profondes et rapides transformations. De nombreux pays mettent à l'essai de nouveaux moyens de financer l'infrastructure de transport et d'offrir sur le marché des services de transport aux voyageurs. Le desserrement des contraintes réglementaires qui pesaient sur les prestations de services de transport des voyageurs a fait surgir de nouvelles façons de répondre aux besoins des voyageurs.

Ces mutations sont loin d'être achevées et les Canadiens ne peuvent ignorer les changements qui surviennent ailleurs dans le monde et les défis qu'ils représentent. Au fur et à mesure que les économies nationales deviendront plus interdépendantes, les choix que feront les Canadiens en matière de projets et d'investissements dans le secteur du transport des voyageurs détermineront de plus en plus la réussite économique du Canada sur le marché mondial. Voilà pourquoi il importe de prendre dès aujourd'hui les bonnes décisions.

En 1990, les Canadiens ont consacré sensiblement plus de ressources au transport (16 pour cent du produit intérieur brut (PIB) qu'aux soins de santé (9 pour cent du PIB)). Selon nos estimations, en 1991, les Canadiens ont dépensé entre 30 et 45 milliards de dollars, soit une moyenne de 1 100 $ à 1 700 $ par personne, pour le transport interurbain des voyageurs.

Le Canada a considérablement changé depuis que la Commission royale MacPherson publiait son rapport il y a 30 ans. Nous croyons que le moment est venu d'élaborer un nouveau cadre pour le système canadien de transport des voyageurs, cadre qui permettra de répondre aux besoins des Canadiens au XXI$^{e}$ siècle.

La Commission royale sur le transport des voyageurs au Canada a été créée le 19 octobre 1989, en vertu de la Partie I de la *Loi sur les enquêtes*, et s'est vu accorder trois années «. . . pour faire enquête et rapport sur un système national intégré de transport interurbain des voyageurs permettant de répondre aux besoins du Canada et des Canadiens au XXI$^e$ siècle. . .»

## COMMENT LA COMMISSION ROYALE A PROCÉDÉ

Avant de formuler des recommandations pour le futur, il importait de comprendre parfaitement le système de transport des voyageurs tel qu'il existe à l'heure actuelle. Pour ce faire, la Commission royale a entrepris trois principales initiatives : nous avons consulté les Canadiens, étudié le transport des voyageurs à l'étranger et réalisé un programme de recherche.

### CONSULTATION DES CANADIENS

Nous avons mis en oeuvre toute une série de moyens — audiences publiques tenues partout au pays, mémoires écrits, télémémoires, réunions et séminaires — pour prendre l'avis des Canadiens intéressés, tant voyageurs et fournisseurs d'infrastructure et de services de transport que gouvernements, contribuables, syndicats, offices de réglementation et groupes d'intérêt spécial, représentant, par exemple, les personnes handicapées et les personnes du troisième âge. Le gros de ce que les Canadiens nous ont dit est exposé dans notre rapport intérimaire, *En marche*.

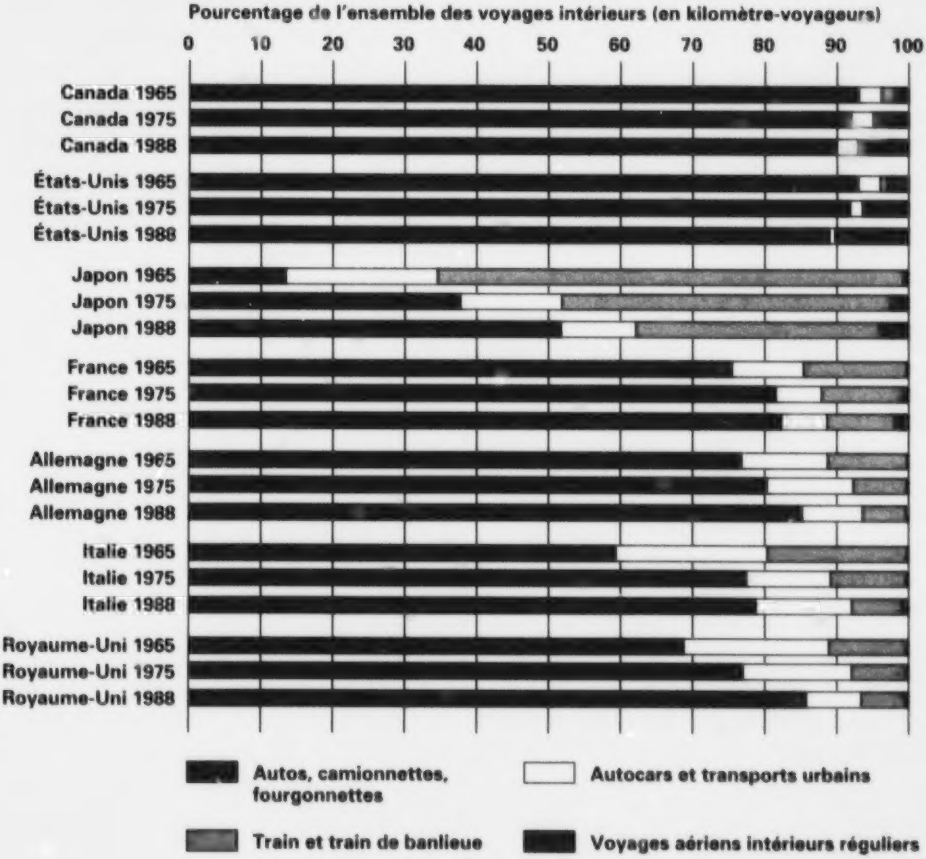
### EXAMEN DES SYSTÈMES DE TRANSPORT DES VOYAGEURS D'AUTRES PAYS

Nous nous sommes également penchés sur la façon dont d'autres pays abordent le dossier du transport des voyageurs. Nous avons découvert que le Canada n'est pas seul à remettre en question les façons traditionnelles de formuler la politique de transport et de prendre les décisions d'investissement, ni à rechercher des solutions nouvelles. Partout dans le monde, les pouvoirs publics s'attachent à rendre leurs systèmes de transport plus performants.

Les habitudes de déplacement des Canadiens sont très semblables à celles des habitants de tous les autres pays développés, même s'il existe certaines différences. La figure qui suit montre que les Canadiens, comme les voyageurs d'autres pays développés, sont très attachés à leur automobile. Le train est un mode de transport des

*Figure 1*

*COMPARAISONS AVEC D'AUTRES PAYS DES PARTS MODALES POUR L'ENSEMBLE DES VOYAGES INTÉRIEURS, 1965, 1975 ET 1988*



**Sources :** Les calculs effectués par le personnel de la Commission sont basés sur les données de Statistique Canada, de la Conférence européenne des ministres des Transports (CEMT) et d'un certain nombre de sources américaines et japonaises. Pour plus de détails, consulter les Notes relatives au chapitre 2 du volume 2 du rapport.

**Nota :** L'ensemble des voyages intérieurs comprend les voyages interurbains et urbains.

voyageurs nettement plus important au Japon, et légèrement plus important en Europe occidentale qu'au Canada ou aux États-Unis. La plupart des pays enregistrent toutefois le même déclin à long terme du train et de l'autocar qu'au Canada. L'avion a quant à lui gagné du terrain partout dans le monde. Vu la grandeur de leurs territoires respectifs, le Canada et les États-Unis comptent beaucoup plus sur l'avion que le Japon ou l'Europe occidentale.

Plusieurs pays ont récemment entrepris des études d'envergure sur le transport et certains en sont déjà au stade de l'exécution de changements. D'autres ont assoupli leur tutelle administrative et économique sur les entreprises de transport des voyageurs. Certains ont examiné des moyens de fixer les prix d'une manière qui reflète le coût véritable des services et de l'infrastructure de transport, tandis que d'autres ont mis à l'essai des modalités administratives et des structures de propriété novatrices.

## NOTRE RECHERCHE SUR LE TRANSPORT INTERURBAIN DES VOYAGEURS

Dans le cadre de notre programme de recherche, nous nous sommes penchés, entre autres, sur :

- la façon dont les Canadiens se déplacent;
- les coûts et leur prise en charge;
- l'incidence des transports sur l'environnement;
- la sécurité de chaque mode; et
- l'accès pour les personnes handicapées.

Nous avons conclu que la manière dont le système de transport est géré au Canada n'est plus adaptée au monde d'aujourd'hui. Pourquoi?

- La plupart des voyageurs ne paient pas le plein coût de leurs déplacements et les prix ne reflètent pas l'usage fait du système par le voyageur;

- Dans aucun des modes, les tarifs, redevances et droits ne couvrent pleinement les frais;
- Les transporteurs individuels sont soumis à des règles et règlements variables;
- Les coûts sont trop élevés parce que les pouvoirs publics n'investissent pas toujours dans les réalisations les plus rentables;
- Les coûts sociaux des transports, et notamment le coût écologique, ne sont presque jamais pris en compte; et
- Les contribuables sont mal renseignés sur les raisons de décisions particulières et sur l'emploi qui est fait de leur argent.

## NOTRE DÉMARCHE

### NOTRE PRINCIPE DIRECTEUR

Si un système de transport des voyageurs largement subventionné par les contribuables a été approprié pour le Canada au cours des 125 dernières années, un tel système n'est pas le bon pour le pays au seuil du XXI$^{e}$ siècle. Aujourd'hui et dans les décennies à venir, ce qu'il faut au Canada, c'est un système qui soit financé par les voyageurs qui l'utilisent et non pas qui repose sur des subventions, des services gouvernementaux et un contrôle centralisé. Le transport des voyageurs devrait être traité comme une activité commerciale.

Au lieu que ce soit les pouvoirs publics qui décident qui peut transporter des passagers, nous croyons que ce qu'il faut, c'est un système régi par le marché. Au lieu que les pouvoirs publics fournissent le gros de l'infrastructure, nous pensons que cela devrait revenir au marché, les premiers se limitant aux rôles d'arbitre et décideurs. Au fur et à mesure que l'on abandonne une tutelle centralisée et souvent éloignée, nous pensons que les responsabilités en matière de transport devraient être confiées au niveau de gouvernement le plus proche de la population et le mieux à même de s'en acquitter efficacement.

Jusqu'à présent, le système de transport des voyageurs a été principalement soutenu financièrement par les contribuables, dont bon nombre ne voyagent que très peu, ou pas du tout. Nous pensons qu'il devrait maintenant s'autofinancer de façon à ce que les voyageurs paient ce qu'ils consomment et en aient pour leur argent.

## NOTRE MÉTHODE : UN CADRE DE RÉFÉRENCE

La Commission royale a examiné le système de transport des voyageurs dans son ensemble. Nous cherchions à résoudre non seulement les questions et problèmes d'aujourd'hui, mais également ceux de demain.

Pour ce faire, nous avons adopté une méthode devant déboucher sur l'établissement d'un cadre de référence à long terme pour le transport des voyageurs. Qu'entendons-nous par «cadre de référence»? Nous entendons par là les lois, règlements et institutions qui régissent les transports.

Trop souvent, les décisions en matière de transport des voyageurs sont incohérentes, à court terme et coûteuses. Une fois en place le cadre de référence que nous prônons, les décisions futures seront logiques, cohérentes et moins onéreuses; une fois comptabilisés les coûts défrayés par toutes les parties.

## NOS ORIENTATIONS : BUT ET OBJECTIFS DU SYSTÈME DE TRANSPORT

Pour jeter les bases de ce nouveau cadre, la Commission royale a défini un but pour le transport des voyageurs et quatre objectifs sur lesquels les Canadiens s'entendent et qui devraient, selon nous, guider le Canada à l'avenir. Nous proposons des solutions canadiennes à des problèmes canadiens.

Nous croyons que le système de transport interurbain des voyageurs au Canada doit poursuivre un but : emmener les gens là où ils veulent aller. Les voyageurs devraient pouvoir choisir les services de transport qu'ils veulent, en payer le prix et en avoir pour leur argent. Ils ne devraient pas être encouragés à se rendre à certains endroits ou à recourir à des modes particuliers par des politiques gouvernementales ou des subventions qui favorisent des destinations ou des modes précis.

Nous recommandons que le système de transport des voyageurs soit guidé par les quatre objectifs suivants :

a) la sécurité;

b) la protection de l'environnement;

c) l'équité envers les contribuables, les voyageurs et les transporteurs; et

d) l'efficience, de telle façon que les services soient assurés uniquement si les avantages qu'ils apportent aux voyageurs individuels en égalent ou excèdent le coût et que des niveaux donnés de service soient fournis au moindre coût possible.
**Recommandation 4.1**

Qu'en est-il d'autres objectifs possibles du système de transport des voyageurs, comme par exemple l'édification nationale et l'expansion économique régionale? Lors des audiences publiques tenues par la Commission royale, certains Canadiens nous ont entretenu de l'importance du transport des voyageurs pour l'édification du pays et le développement régional. L'édification de la nation et le développement régional devraient être des objectifs des différents paliers de gouvernement, mais devrait-il s'agir d'objectifs à poursuivre grâce au transport des voyageurs? Nous pensons que non. Les politiques en matière de transport des voyageurs ne devraient pas être guidées par les objectifs d'édification de la nation et d'expansion économique régionale pour les raisons qui suivent.

*Édification de la nation :* De manière générale, le système de transport des voyageurs est parvenu à maturité, et la plupart des Canadiens sont bien desservis par les divers modes. Nous pensons qu'aucun projet, qu'aucune route, qu'aucun réseau ou mode n'est susceptible aujourd'hui de devenir un symbole national unificateur, comme ce fut le cas jadis du chemin de fer transcontinental. Nous doutons que quelque nouveau mégaprojet de transport des voyageurs puisse contribuer à l'édification de la nation, au-delà de son utilité économique, qui peut être évaluée selon les critères que nous recommandons.

*Expansion économique régionale :* Nous reconnaissons que l'infrastructure et les services de transport des voyageurs peuvent jouer un rôle vital dans le développement et le fonctionnement des économies nationales et régionales. Nous avons cependant tiré de nos recherches et de nos consultations la conclusion que les avantages distincts et supplémentaires qui pourraient en résulter sur le plan du développement régional n'ont guère de chances d'être substantiels et qu'il n'y a donc pas lieu d'aligner les politiques de transport des voyageurs sur ces seules considérations.

En conséquence, nous recommandons :

- Que les pouvoirs publics poursuivent les objectifs d'édification de la nation et d'expansion économique régionale au moyen d'autres programmes, plutôt que par le biais du système de transport des voyageurs.
  **Recommandation 4.2**

## QUELLE INCIDENCE NOS RECOMMANDATIONS AURONT-ELLES SUR LES VOYAGEURS?

**Les voyageurs devraient payer les coûts véritables des services de transport qu'ils utilisent, y compris les coûts des dommages causés à l'environnement, et les sédentaires ne devraient pas avoir à payer pour ceux qui voyagent.**

Les contribuables ne subventionneront plus les voyageurs, comme ils le font à l'heure actuelle.

Nous recommandons :

- Que chaque voyageur paie le coût intégral de son déplacement et que les voyageurs dans leur ensemble assument le plein coût du système, y compris les coûts liés à la protection de l'environnement, à la sécurité et aux accidents.
  **Recommandation 4.3**

Certains voyageurs canadiens n'apprécieront sans doute pas que nous recommandions qu'ils se voient imposer des droits et des redevances de transport. Il importe de souligner qu'à l'heure actuelle les coûts du transport des voyageurs sont couverts soit par les tarifs, soit par des taxes et par l'impôt sur le revenu. Nous pensons tout simplement que le système de transport serait plus juste pour tout le monde si le fardeau financier était déplacé de ceux qui ne l'utilisent pas à ceux qui l'utilisent.

**À l'heure actuelle, les contribuables financent sciemment les transports au moyen de subventions directes et ils les financent à leur insu au moyen de subventions cachées.**

Les subventions directes sont celles qui figurent en tant que montants transférés des contribuables aux transporteurs et aux voyageurs dans les budgets établis par les gouvernements. Les subventions cachées sont celles qui sont moins visibles du fait qu'elles ne figurent pas dans les comptes des pouvoirs publics.

Selon le schéma que nous proposons, voyageurs et transporteurs paieront l'intégralité des coûts, mais ceux-ci seront établis dans un contexte de principes d'investissement et de tarification efficients. Les voyageurs ne paieront pas un système de transport trop coûteux et gaspilleur parce qu'il est doté d'une capacité ou trop grande ou trop petite, inadaptée ou située au mauvais endroit. Voyageurs et transporteurs pourront acheter les services dont ils ont besoin au plus bas prix possible.

Le tableau 1 donne une vue d'ensemble des éléments du système de transport interurbain des voyageurs.

*Tableau 1*
*ÉLÉMENTS DU SYSTÈME DE TRANSPORT*

| **Mode** | **Transporteur** | **Infrastructure** | | |
|---|---|---|---|---|
| | | **Terminaux** | **Liens** | **Contrôle de la circulation** |
| **Routier** | Automobiles | Terrains de stationnement | Routes (ponts compris) | Police, signalisations routières, code de la route et règlements |
| | Autocars | Gares routières | | |
| **Aérien** | Avions | Aéroports (pistes comprises) | Systèmes de navigation aérienne | Contrôle de la circulation aérienne |
| **Ferroviaire** | Trains | Gares ferroviaires | Voies ferrées | Répartition, systèmes de signalisation |
| **Maritime** | Traversiers | Terminaux portuaires (y compris quais et embarcadères) | Voies navigables et canaux (y compris les aides à la navigation) | Contrôle de la circulation maritime |

Les tableaux 2(a) et 2(b) illustrent les coûts à l'échelle du système des voyages interurbains intérieurs et la part qui revient à chacun. Dans la rubrique «usagers», les tableaux donnent des estimations des coûts payés par les voyageurs et des coûts payés par les transporteurs qui seront répercutés sur les voyageurs.

Sous la rubrique «autres», les tableaux donnent les coûts qui ne reviennent pas aux voyageurs. Il s'agit, pour la plupart, de coûts qui sont payés par les contribuables, mais y figurent également des estimations des dommages environnementaux qui sont à l'heure actuelle payés par le public. Les coûts payés pas les autres représentent une mesure d'ensemble des subventions aux voyageurs.

Les tableaux montrent que c'est le transport par autocar qui est le moins coûteux, son coût total moyen se chiffrant à 9,5¢ par kilomètre-voyageur. Selon nos estimations, les voyageurs paient tout sauf 0,4¢ par kilomètre-voyageur. Les personnes qui se déplacent en voiture et en avion reçoivent une subvention totale sensiblement supérieure. En effet, les contribuables et le public subventionnent les déplacements en voiture à raison d'environ 1,8¢ par kilomètre-voyageur et les déplacements aériens de 3,6¢ par kilomètre-voyageur. Ces subventions couvrent les coûts d'infrastructure, environnementaux et d'accidents qui ne sont pas payés par les usagers, ainsi que certaines petites subventions directes versées au transport aérien dans certaines provinces, moins les taxes spéciales perçues par les gouvernements fédéral ou provinciaux.

*Tableau 2(a)*

*COÛTS ANNUELS DES VOYAGES INTERURBAINS INTÉRIEURS POUR LE SYSTÈME DANS SON ENSEMBLE, PAYÉS PAR LES USAGERS ET PAR LES AUTRES, 1991, EN DOLLARS DE 1991*

| Coûts moyens en cents par kilomètre-voyageur | | | | | | |
|---|---|---|---|---|---|---|
| | **Automobile** | | | **Autocar** | | |
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 0,0 | 2,1 | 2,1 | 0,0 | 0,3 | 0,3 |
| **Environnement** | 0,0 | 0,6 | 0,6 | 0,0 | 0,2 | 0,2 |
| **Accidents** | 3,7 | 0,1 | 3,8 | 0,4 | 0,0 | 0,4 |
| **Taxes/redevances spéc. de transp.** | 1,2 | –1,2 | 0,0 | 0,3 | –0,3 | 0,0 |
| **Véhicules/transporteurs** | 10,9 | 0,0 | 10,9 | 8,4 | 0,2 | 8,6 |
| **Total** | **15,8** | **1,6** | **17,4** | **9,1** | **0,4** | **9,5** |

| | **Avion** | | | **Train** | | |
|---|---|---|---|---|---|---|
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 2,2 | 3,4 | 5,6 | 2,9 | 0,0 | 2,9 |
| **Environnement** | 0,0 | 1,0 | 1,0 | 0,0 | 0,6 | 0,6 |
| **Accidents** | 0,1 | 0,0 | 0,1 | 0,2 | 0,0 | 0,2 |
| **Taxes/redevances spéc. de transp.** | 0,6 | –0,6 | 0,0 | 0,4 | –0,4 | 0,0 |
| **Véhicules/transporteurs** | 14,4 | 0,1 | 14,4 | 7,4 | 32,8 | 40,2 |
| **Total** | **17,3** | **3,8** | **21,1** | **10,9** | **33,0** | **43,9** |

| | **Traversier** | | | **Voyages interurbains totaux** | | |
|---|---|---|---|---|---|---|
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 0,0 | 4,7 | 4,7 | **0,2** | **2,2** | **2,4** |
| **Environnement** | 0,0 | 2,0 | 2,0 | **0,0** | **0,6** | **0,6** |
| **Accidents** | 0,1 | 0,0 | 0,1 | **3,3** | **0,2** | **3,4** |
| **Taxes/redevances spéc. de transp.** | 0,9 | –0,9 | 0,0 | **1,1** | **–1,1** | **0,0** |
| **Véhicules/transporteurs** | 24,1 | 11,6 | 35,7 | **11,2** | **0,2** | **11,4** |
| **Total** | **25,1** | **17,4** | **42,5** | **15,8** | **2,0** | **17,8** |

*Tableau 2(b)*

*COÛTS ANNUELS DES VOYAGES INTERURBAINS INTÉRIEURS POUR LE SYSTÈME DANS SON ENSEMBLE, PAYÉS PAR LES USAGERS ET PAR LES AUTRES, 1991, EN DOLLARS DE 1991*

| Totaux : en millions de dollars | | | | | | |
|---|---|---|---|---|---|---|
| | **Automobile<br>(210 milliards de km-voyageurs)** | | | **Autocar<br>(3,3 milliards de km-voyageurs)** | | |
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 0 | 4 486 | 4 486 | 0 | 10 | 10 |
| **Environnement** | 0 | 1 211 | 1 211 | 0 | 8 | 8 |
| **Accidents** | 7 874 | 172 | 8 046 | 13 | 0 | 13 |
| **Taxes/redevances spéc. de transp.** | 2 461 | –2 461 | 0 | 9 | –9 | 0 |
| **Véhicules/transporteurs** | 22 817 | 0 | 22 817 | 277 | 8 | 285 |
| **Total** | **33 152** | **3 408** | **36.560** | **299** | **17** | **316** |
| | **Avion<br>(25 milliards de km-voyageurs)** | | | **Train<br>(1,4 milliard de km-voyageurs)** | | |
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 556 | 845 | 1 401 | 41 | 0 | 41 |
| **Environnement** | 0 | 247 | 247 | 0 | 9 | 9 |
| **Accidents** | 25 | 0 | 25 | 3 | 0 | 3 |
| **Taxes/redevances spéc. de transp.** | 149 | –149 | 0 | 6 | –6 | 0 |
| **Véhicules/transporteurs** | 3 595 | 0 | 3 595 | 104 | 459 | 563 |
| **Total** | **4 325** | **943** | **5 268** | **154** | **462** | **616** |
| | **Traversier<br>(0,85 milliard de km-voyageurs)** | | | **Voyageurs interurbains totaux<br>(240 milliards de km-voyageurs)** | | |
| **Type de coût** | **Usagers** | **Autres** | **Total** | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 0 | 40 | 40 | 597 | 5 381 | 5 978 |
| **Environnement** | 0 | 17 | 17 | 0 | 1 492 | 1 492 |
| **Accidents** | 1 | 0 | 1 | 7 916 | 172 | 8 088 |
| **Taxes/redevances spéc. de transp.** | 7 | –7 | 0 | 2 632 | –2 632 | 0 |
| **Véhicules/transporteurs** | 205 | 98 | 303 | 26 998 | 565 | 27 563 |
| **Total** | **213** | **148** | **361** | **38 143** | **4 978** | **43 121** |

**Nota :** **Pour faire ressortir les composantes plus petites, les moyennes ont été arrondies au dixième de cent le plus près et les totaux au million de dollars le plus près. De façon générale, les estimations de côuts sont approximatives et ne sont pas exactes à ce niveau de précision.**

C'est pour le train et le traversier que l'on enregistre les plus grands écarts entre les coûts pour les «usagers» et les «coûts totaux», soit 33¢ par kilomètre-voyageur pour le train et 17,4¢ par kilomètre-voyageur pour le traversier. Cela est en grande partie attribuable aux importantes subventions directes versées par les contribuables aux voyageurs qui utilisent le train et certains services de traversier. Pour une interprétation de ces tableaux, voir *Directions*, volume 1, chapitre 3.

Notre recommandation selon laquelle les voyageurs devraient payer l'intégralité du coût de leur transport signifie que ceux qui recourent à un mode de transport public, par exemple l'autocar, le train, l'avion commercial ou le traversier, ainsi que ceux qui se déplacent en voiture ou en avion privé, paieraient des tarifs, des droits ou des redevances suffisants pour couvrir leur part du plein coût de la prestation des services qu'ils utilisent. Cette recommandation signifie également que le fardeau qui revient aux contribuables serait réduit en conséquence.

Si les voyageurs devaient payer l'intégralité du coût de leurs déplacements, ils paieraient également, au moyen soit d'un pourcentage du prix de leur billet, soit d'une taxe ou d'une redevance, tout dommage environnemental causé par eux et tous les coûts relatifs à la sécurité et aux accidents occasionnés par leurs déplacements.

Les redevances pour dommages environnementaux sont traitées dans les **Recommandations 7.4** et **7.5** et devront couvrir, entre autres choses, les coûts de nettoyage et d'atténuation des impacts ainsi que celui de l'administration des politiques et règlements. La **Recommandation 7.6** stipule, quant à elle, que les redevances devront s'appliquer de façon égale à tous les modes.

Pour des explications plus détaillées sur l'environnement et le texte intégral des Recommandations 7.1 à 7.7, voir *Directions*, volume 1, chapitre 7.

Les redevances correspondant aux coûts de sécurité et d'accidents devront englober le coût des services de sécurité assurés par les pouvoirs publics et les coûts de soins de santé qui reviennent à l'heure actuelle au régime d'assurance-maladie.

**Recommandation 8.1**

Pour des renseignements plus complets sur la sécurité et le texte intégral des Recommandations 8.1 et 8.2, voir *Directions*, volume 1, chapitre 8.

## L'accès des personnes handicapées au transport

Près de 10 pour cent des personnes handicapées adultes au sein de la population canadienne ont des déficiences handicapantes pour le transport. Le tableau qui suit donne une estimation du nombre de Canadiens ayant une déficience handicapante pour le transport, par type de déficience.

**Les personnes handicapées devraient bénéficier d'un meilleur accès au système de transport des voyageurs.**

*Tableau 3*

*NOMBRE DE PERSONNES AYANT UNE DÉFICIENCE HANDICAPANTE POUR LE TRANSPORT, PAR TYPE DE DÉFICIENCE, 1990*

| | Nombre | Pourcentage[a] |
|---|---|---|
| Tous les Canadiens de 15 ans et plus ayant une déficience handicapante pour le transport | 1 879 615 | 100,0 |
| Déficience mentale | 714 398 | 38,0 |
| Déficience auditive | 648 780 | 34,5 |
| Déficience visuelle | 417 990 | 22,2 |
| Déficience vocale | 159 843 | 8,5 |
| Déficience motrice (fauteuil roulant ou déambulateur) | 132 660 | 7,1 |
| Cécité | 42 176 | 2,2 |
| Déficience non précisée | 37 052 | 2,0 |

**Sources : Hickling Corporation, chiffres tirés de l'Enquête sur la santé et les limitations d'activités de Statistique Canada, 1987 avec projections jusqu'en 1990; *Transportation for People with Disabilities: A Policy Review and Analysis*, rapport rédigé à l'intention de la Commission royale sur le transport des voyageurs au Canada, RR-01, mars 1991, p. 5.**

**[a] Les pourcentages totalisent plus de 100 car certaines personnes ont plusieurs déficiences. Les chiffres comprennent les personnes résidant dans des établissements mais non celles confinées à la maison (environ 37 600).**

S'il est vrai que les pouvoirs publics et le secteur privé ont déjà beaucoup fait pour donner aux personnes handicapées l'accès aux services de transport interurbain, notre démarche va plus loin. Nous recommandons :

- Que les voyageurs ayant des déficiences physiques ou mentales jouissent de possibilités similaires d'emprunter les moyens de transport en commun que tous les Canadiens.
  **Recommandation 4.4**

Nous recommandons par ailleurs :

Que les pouvoirs publics se fixent pour objectif de donner à tous les voyageurs du Canada l'accès au transport public dans des conditions de sécurité, de confort raisonnable et de dignité, quelles que soient leurs déficiences physiques ou mentales.
**Recommandation 9.1**

En ce qui concerne les transporteurs et fournisseurs d'infrastructure, nous recommandons : qu'ils veillent dès aujourd'hui à ce que leurs spécifications pour les équipements et installations offrent aux personnes handicapées des améliorations continues de l'accessibilité; qu'ils paient le passage d'un accompagnateur s'ils décident, pour des raisons de sécurité, qu'un accompagnateur est nécessaire; et qu'ils veillent à ce que le personnel en contact avec les voyageurs handicapés possède la formation voulue pour les traiter avec sensibilité et compréhension.
**Recommandations 9.3, 9.8 et 9.9**

Nous recommandons également un rôle élargi pour l'Office national des transports (ONT) en ce qui concerne les personnes handicapées, et, plus précisément : que l'ONT établisse des normes nationales minimales d'accessibilité; qu'il veille plus activement à ce que les services de transport deviennent davantage accessibles aux personnes handicapées; et qu'il soit chargé d'arbitrer les différends concernant la nécessité d'un accompagnateur.
**Recommandations 9.2, 9.4 et 9.7**

Nous recommandons par ailleurs :

- Que, par concertation entre les associations représentatives des personnes handicapées, les associations de transporteurs et l'Office national des transports, soit mis sur pied un mécanisme, tel qu'un système de carte d'identification codée, afin d'indiquer rapidement au personnel des transporteurs le genre de services dont chaque voyageur handicapé a besoin, et notamment la nécessité d'un accompagnateur pour raisons de sécurité ou d'autres motifs.
  **Recommandation 9.6**

Pour plus de précisions sur l'accès des personnes handicapées aux services de transport et le texte intégral des Recommandations 9.1 à 9.11, voir *Directions*, volume 1, chapitre 9.

## QUELLE INCIDENCE NOS RECOMMANDATIONS AURONT-ELLES SUR LES TRANSPORTEURS?

**Les transporteurs de voyageurs devraient être exposés à la concurrence et aux pressions du marché de façon à devoir réagir aux préférences des consommateurs et à réduire leurs coûts, à améliorer l'efficience et à répercuter les économies qui en résultent sur les voyageurs.**

### Le transport des voyageurs au Canada et le marché

Nous recommandons :

- Que la concurrence et les forces du marché soient les principaux déterminants de services de transport viables et efficients.
  **Recommandation 4.5**

Afin que le marché puisse imposer cette discipline, les pouvoirs publics faciliteront l'entrée sur le marché de nouveaux concurrents en éliminant ou en assouplissant les restrictions. Quiconque est «prêt, apte et disposé» aura la possibilité d'offrir des services de transport des voyageurs. En outre, les nouveaux entrants auront accès sur un pied d'égalité à l'infrastructure de transport pourvu qu'ils soient disposés à payer leur part des coûts. Comme nous l'avons déjà dit, ces coûts comprennent tous ceux liés à la dégradation de l'environnement, à la sécurité et aux accidents, imposés par les voyageurs. Par ailleurs, quiconque assure des services de transport pourra les interrompre sans période d'attente excessive, mais avec un délai de préavis suffisant.

En conséquence, nous recommandons :

- Que les gouvernements fédéral, provinciaux et territoriaux modifient leur législation relative à la réglementation des autocars de manière à ramener les restrictions à l'entrée sur le marché aux seuls critères de «prêt, apte et disposé» et à ne plus exiger qu'un préavis suffisant avant l'abandon de routes et la publication des horaires et tarifs.
  **Recommandation 13.1**

- Que le gouvernement fédéral invite les transporteurs aériens canadiens à soumettre des propositions publiques pour de nouvelles routes aériennes internationales désignées, la compagnie offrant la meilleure formule se voyant accorder la liaison et les motifs de la décision étant rendus publics, et que les transporteurs aériens canadiens soient autorisés à se vendre entre eux des liaisons aériennes internationales désignées.
  **Recommandations 11.3 et 11.4**

- Que les pouvoirs publics s'abstiennent de faire toute contribution financière qui vise à assurer la survie de transporteurs aériens.
  **Recommandation 11.5**

- Que le gouvernement fédéral modifie les dispositions législatives intéressant l'accès aux voies de manière à préciser que tous les transporteurs qualifiés disposés à payer leur quote-part ont le droit d'accès à l'infrastructure ferroviaire essentielle et à l'égalité de traitement dans le transport ferroviaire.
  **Recommandation 6.7**

- Que les aéroports et les autorités municipales coopèrent pour assurer un accès illimité aux aéroports à tous les transporteurs de surface qui paient leur juste part des coûts et que les autorités fédérales accordent à tous les transporteurs de surface le libre accès aux aéroports et gares ferroviaires appartenant au gouvernement fédéral.
  **Recommandation 15.1**

- Que tous les contrats de vente ou de location relatifs à l'infrastructure de transport fédérale comprennent des dispositions obligeant l'exploitant à donner à tous les transporteurs intermodaux libre accès à cette infrastructure, sur un pied d'égalité.
  **Recommandation 15.2**

**Une exception à la règle . . .**

Aux termes des accords internationaux actuels, si une compagnie aérienne canadienne n'est plus détenue et contrôlée par des Canadiens, sa désignation en tant que «compagnie aérienne nationale» pourrait être contestée et, par voie de conséquence, sa faculté de desservir des routes internationales compromise.

Même si la Commission royale recommande qu'il n'y ait aucune restriction en matière de propriété pour les autres modes, nous faisons une exception pour les transporteurs aériens étant donné l'actuel régime de réglementation international.

En ce qui concerne la propriété des compagnies aériennes, nous recommandons :

- que le gouvernement fédéral et le gouvernement de l'Alberta modifient leur législation de façon à éliminer le plafond de 10 pour cent relatif aux avoirs individuels qui s'applique à l'heure actuelle à Air Canada et à Pacific Western Airlines (la société mère des Lignes aériennes Canadien International).
  **Recommandation 11.2**

- que le gouvernement fédéral maintienne les limites existantes applicables à la propriété et au contrôle par des étrangers de transporteurs aériens.
  **Recommandation 11.1**

- qu'advenant une situation où il ne resterait plus qu'un important transporteur aérien canadien, le gouvernement fédéral utilise son pouvoir pour annuler les limites imposées en matière de propriété et de contrôle étrangers dans le but exprès, et dans la mesure requise, de garantir la concurrence sur le marché intérieur.
  **Recommandation 11.6**

Pour plus de renseignements au sujet de la «propriété» en ce qui concerne le transport aérien, voir *Directions*, volume 1, chapitre 11.

## QUELLE INCIDENCE NOS RECOMMANDATIONS AURONT-ELLES SUR LES FOURNISSEURS D'INFRASTRUCTURE?

**Les fournisseurs d'éléments d'infrastructure de transport devraient faire payer leurs services. Ceux qui n'en tirent pas avantage ne devraient pas avoir à les payer.**

Transporteurs et voyageurs nous ont dit que si l'on va leur demander de payer le plein coût des terminaux comme les aéroports, des liens comme les routes et les voies ferrées, et des services de contrôle aérien, ils veulent être certains que ce qui est fourni correspond aux besoins, ni plus, ni moins. La Commission est d'accord et recommande :

- que les terminaux, les liens et les services de contrôle de la circulation soient tarifés individuellement, terminal par terminal, lien par lien et service par service.
  **Recommandation 4.6**

- que, lorsque la concurrence est suffisante, ou lorsque les passagers sont en bonne position pour négocier avec les fournisseurs de terminaux, de liens ou de services de contrôle de la circulation — et

pourvu que les frais de dégradation de l'environnement, de sécurité et d'accidents soient adéquatement recouvrés — on laisse la concurrence et les forces du marché déterminer les prix et les décisions d'investissement.
**Recommandation 4.7**

- que là où une réglementation est requise, elle soit conçue de telle manière que les prix et les décisions d'investissement soient similaires à ce que produiraient les forces du marché concurrentiel
**Recommandation 4.8**

## LA FIXATION DES PRIX

**Les voyageurs ne devraient payer que ce qu'ils utilisent.**

Les prix refléteront l'utilisation faite par les voyageurs ou transporteurs de chaque terminal, lien ou service de contrôle de la circulation et seront conçus de manière à n'encourager ni la surutilisation ni la sous-utilisation.

Lorsque les tarifs actuels sont inférieurs au prix de revient tout compris du service, ils seront rajustés de façon à recouvrer intégralement les coûts et de manière à minimiser la perte d'efficience.

En conséquence, nous recommandons :

- Que l'on envisage de recourir à des systèmes conventionnels de perception de péage lorsque de nouvelles routes d'accès limité sont requises, les droits de péage étant fixés de manière à couvrir la différence entre le coût total du lien routier considéré et les recettes correspondantes des taxes sur le carburant.
**Recommandation 5.6**

- Que les gouvernements provinciaux taxent les camions selon le poids et la distance dans le cadre d'un programme de financement routier d'ensemble.
**Recommandation 5.5**

- Que les exploitants des aéroports tirent leurs ressources de redevances spécifiques calculées aéroport par aéroport, plutôt que des recettes de la taxe sur le transport aérien. Les redevances payées par les voyageurs refléteront le potentiel commercial de l'aéroport et non son coût de construction.
  **Recommandations 5.1 et 5.3**

- Que l'exploitant du système de navigation aérienne se finance en faisant payer directement aux exploitants des aéronefs leur part du coût des services de navigation aérienne et de contrôle de la circulation aérienne, au moyen de redevances variables selon le type de vol, la catégorie d'aéronef et la valeur des avantages obtenus, plutôt que par le biais de la taxe sur le transport aérien. Ce système remplacerait la taxe sur le transport aérien.
  **Recommandation 5.7**

La décision de passer à la tarification lien par lien du réseau routier actuel dépendra, en partie, de la viabilité technologique, du coût administratif et de la réaction du public.

Pour les projets routiers, nous recommandons :

- Que les gouvernements provinciaux et territoriaux financent leur réseau routier et tous les travaux convenus sur le système routier national à l'intérieur de leurs frontières au moyen des taxes sur le carburant et autres redevances.
  **Recommandation 6.6**

Pour plus de détails sur l'investissement et la tarification ainsi que le texte complet des Recommandations 5.1 à 5.7, voir *Directions*, volume 1, chapitres 5 et 6.

## Investir dans le transport

**Des investissements ne seront consentis que pour les projets qui présentent pour les voyageurs des avantages supérieurs aux coûts et dans ceux qui offrent la rentabilité optimale, quel que soit le mode de transport considéré.**

En conséquence, nous recommandons :

- Qu'aux fins de la cession des aéroports à des administrations aéroportuaires locales, le gouvernement fédéral estime la valeur des installations aéroportuaires existantes en fonction du potentiel commercial de l'aéroport et non de son coût de construction.
  **Recommandation 5.3**
- Que les pouvoirs publics ou les administrations aéroportuaires locales décident des investissements ponctuellement, aéroport par aéroport, et n'en effectuent que lorsqu'ils peuvent compter que le coût, y compris un rendement sur l'investissement, sera couvert par les recettes futures.
  **Recommandations 5.1 et 5.3**
- Que les autorités provinciales et territoriales, pour déterminer l'ampleur de la rénovation et de l'amélioration du réseau routier national, se laissent guider par la comparaison des avantages et des coûts des projets individuels plutôt que par des normes techniques uniformes.
  **Recommandation 6.4**
- Que les pouvoirs publics investissent dans l'infrastructure ferroviaire à grande vitesse uniquement si les avantages à l'échelle du système de transport des voyageurs l'emportent sur les coûts et si les contribuables n'ont pas à payer de subventions d'exploitation.
  **Recommandation 12.6**
- Que toute compagnie de chemin de fer soit autorisée à abandonner une longueur illimitée de voies.
  **Recommandation 6.8**

- Que tous les organismes responsables utilisent des valeurs comparables pour les blessures et décès lorsqu'ils évaluent tout projet d'amélioration de la sécurité dans les divers modes.
  **Recommandation 8.2**

## QUELLE INCIDENCE NOS RECOMMANDATIONS AURONT-ELLES SUR LES POUVOIRS PUBLICS?

**Le transport devrait être retranché du régime fiscal et budgétaire gouvernemental et intégré à un régime qui soit financé et maintenu par les usagers du système.**

Nous avons dit que la concurrence et les forces du marché devraient être les principaux déterminants dans l'établissement d'un système viable et efficient de transport des voyageurs. Il est cependant un certain nombre de fonctions à l'intérieur du système qui ne devraient revenir qu'aux pouvoirs publics.

- Il incombera aux pouvoirs publics de formuler les politiques à l'intérieur du cadre de référence, d'arrêter et faire respecter les normes, de rassembler et disséminer l'information auprès du public, d'assurer une quantité suffisante de recherches, de préserver la concurrence et de réglementer les monopoles.
  **Recommandation 4.9**

Les ministères des Transports fédéral, provinciaux et territoriaux devraient voir leurs effectifs diminuer puisque leur rôle se limitera à la formulation des politiques. Ils devraient céder la plupart de leurs responsabilités opérationnelles. Quelques organismes publics pourront encore être appelés à fournir certains services de transport et à exploiter quelques infrastructures. Cependant, ils devront pour cela se passer de subventions, et des entreprises privées seront libres, de façon générale, de desservir ces marchés en concurrence avec eux.

En conséquence, nous recommandons :

- Que le gouvernement fédéral procède au transfert de tous les aéroports fédéraux restants à des administrations aéroportuaires locales et (ou) à d'autres exploitants locaux, et qu'il fasse passer le système de navigation aérienne du statut d'organisation ministérielle à celui de société d'État ou d'institution indépendante.
  **Recommandations 6.1 et 6.2**
- Que chaque gouvernement provincial et territorial mette sur pied une société d'État, complétée d'un organisme consultatif, afin de fournir les routes de manière plus efficiente et de rendre plus transparentes les décisions en matière de tarification et d'investissement routier.
  **Recommandation 6.3**
- Que les compagnies de chemin de fer offrent les emprises ferroviaires abandonnées, selon une procédure officielle, aux divers paliers de gouvernement puis à d'autres sociétés ferroviaires avant qu'elles puissent être converties à d'autres fins. Tous les niveaux de gouvernement se doteront de politiques, assorties de critères explicites, pour déterminer quels couloirs ils souhaitent conserver pour le transport futur et veilleront à ce que les terrains ainsi acquis restent intacts.
  **Recommandation 6.9**

Nous recommandons en outre que le gouvernement fédéral :

- Réexamine la *Loi sur la concurrence* ainsi que la politique pertinente et, au besoin, renforce les pouvoirs requis pour empêcher que des pratiques anticoncurrentielles ne s'installent dans le secteur du transport interurbain par autocar.
  **Recommandation 13.2**
- Étende sa réglementation régissant les pratiques anticoncurrentielles dans les systèmes de réservation informatisés aux modes autres que le transport aérien, dans le cadre d'une approche multimodale.
  **Recommandation 15.3**

- Fixe le régime réglementaire qui sera applicable à tout système de train à grande vitesse, y compris la réglementation sécuritaire et environnementale.
  **Recommandation 12.8**

Nous recommandons en outre que l'Office national des transports :

- Veille à ce que les couloirs ferroviaires abandonnés soient offerts aux pouvoirs publics ou à d'autres sociétés ferroviaires à un prix raisonnable.
  **Recommandation 6.9**

Nous recommandons également que les gouvernements provinciaux et territoriaux :

- Mettent en place des normes minimales plus uniformes et plus adéquates en ce qui concerne l'accessibilité des autocars interurbains par les voyageurs handicapés. À défaut, le gouvernement fédéral réassumera la responsabilité en matière de normes d'accessibilité nationales déléguée aux provinces, dans le but d'assurer une plus grande uniformité.
  **Recommandation 9.10**

Nous recommandons d'autre part que tous les pouvoirs publics :

- Améliorent les données sur les voyages et les transports à l'intention du public et que le gouvernement fédéral publie un rapport annuel sur le système de transport des voyageurs.
  **Recommandations 16.2, 16.3 et 16.4**

Nous avons conscience que les politiques d'un niveau de gouvernement portant sur un mode de son ressort peuvent entraîner des répercussions sur d'autres modes qui relèvent d'un autre palier. Néanmoins, ce genre d'interaction ne pose pas en soi de problème dès lors que tous les modes assument l'intégralité de leurs coûts.

En conséquence, nous recommandons :

- Que les pouvoirs gouvernementaux de décision soient attribués au palier de gouvernement le plus proche du public et le mieux à même de les exercer avec efficience.
  **Recommandation 4.10**

Nous pensons par ailleurs que notre cadre de référence peut être mis en place au moyen d'une démarche concertée et sans modification des modalités juridictionnelles actuelles.

En conséquence, nous recommandons :

- Que le Conseil des ministres responsables des transports et de la sécurité routière désigne un système routier national dont l'exploitation et l'entretien feront l'objet d'une action concertée des gouvernements provinciaux et territoriaux et (ou) de leurs organismes de gestion routière.
  **Recommandation 6.5**
- Que les autorités locales ou régionales assument la responsabilité des dégradations causées à l'environnement lorsque leur source et leurs effets sont locaux.
- Que le gouvernement fédéral ait compétence lorsque les retombées environnementales enjambent les limites régionales ou les frontières nationales, et qu'il continue de rechercher une entente internationale sur une stratégie efficace de lutte contre le réchauffement planétaire et de chercher à harmoniser les politiques et taxes nationales avec celles de la communauté internationale.
  **Recommandation 7.2**

## Tous les modes seront traités sur un pied d'égalité

Nous recommandons :

- Que les pouvoirs publics taxent et réglementent tous les modes sur un pied d'égalité.
  **Recommandation 4.11**

Nous recommandons :

- Que toutes les taxes sur le carburant soient utilisées aux fins du transport ou comme moyen de recouvrer les coûts engendrés par le transport, tels que les frais de dégradation de l'environnement et les dépenses de santé.
  **Recommandation 5.4**
- Que les pouvoirs publics appliquent les redevances sur les émissions de façon égale à tous les modes de transport, ainsi qu'aux sources qui ne sont pas liées au transport, selon une formule qui se rapproche le plus possible d'un calcul par unité d'émission.
  **Recommandation 7.6**
- Que les pouvoirs publics promulguent des règlements visant le contrôle efficace des émissions dommageables pour l'environnement qui imposent des obligations semblables, en coût par unité de réduction, à chaque mode, et qui traitent de la même façon les sources de polluants non liées au transport.
  **Recommandation 7.3**
- Que les pouvoirs publics distinguent clairement les revenus en provenance des redevances sur les émissions de ceux en provenance d'autres redevances de transport et qu'ils utilisent ces revenus pour pallier aux dégâts, indemniser les personnes touchées ou faire baisser l'impôt général. Ils ne devraient pas utiliser ces revenus pour l'expansion ou l'entretien du système de transport des voyageurs.
  **Recommandation 7.7**

## Amélioration de la reddition de comptes et de la transparence

**Les coûts du système de transport devraient être visibles et les pouvoirs publics devraient être tenus de rendre compte de leurs décisions.**

Les décisions en matière de transport des voyageurs faites par les pouvoirs publics devraient être claires, visibles et directes, et tous les coûts devraient être rendus publics. En conséquence, nous recommandons :

- Que la prise de décision soit transparente, de telle façon que les Canadiens comprennent les raisons des choix en matière de transport opérés par les gouvernements ou leurs organismes et que les responsables de ces décisions aient à rendre des comptes.
  **Recommandation 4.12**

Pour assurer la transparence du processus décisionnel, nous recommandons en outre :

- Que, si les organismes créés pour fournir l'infrastructure de transport en ont le monopole, le niveau de gouvernement responsable veille à créer des conseils consultatifs de voyageurs et autres intéressés afin qu'ils conseillent la direction de ces organismes quant aux priorités d'investissement, aux méthodes de tarification et aux redevances appropriées pour parvenir à l'autofinancement.
  **Recommandation 16.1**
- Que les pouvoirs publics informent le public d'une manière claire du montant et des motifs de toute subvention qui continuera d'être versée aux transporteurs.
  **Recommandations 12.5, 14.4 et 16.4**
- Que le gouvernement fédéral affecte des ressources à la collecte et à l'amélioration des données sur les voyages et les transports, que les gouvernements provinciaux, territoriaux et fédéral collaborent à cet effet, et que ces renseignements soient communiqués au public.
  **Recommandations 16.2 et 16.3**

- Que le gouvernement fédéral publie chaque année un rapport sur le système de transport des voyageurs, comprenant des renseignements sur l'utilisation des services de transport, les subventions, le recouvrement des coûts et la mesure dans laquelle les objectifs sont réalisés, de même que des données sur la fiabilité et la sécurité du système de transport des voyageurs.
  **Recommandation 16.4**

## PRÉVOIR LA TRANSITION

Nous avons conscience que le système de transport des voyageurs qui prendra forme à l'intérieur de notre cadre de référence sera différent de l'actuel système et que les gouvernements devront accorder aux voyageurs, transporteurs et fournisseurs d'installations le temps nécessaire pour s'adapter.

En conséquence, nous recommandons :

- Que dans les cas où une période transitoire est requise pour étaler les ajustements de prix ou lorsqu'un sursis est accordé à un transporteur, un service particulier d'un transporteur, un terminal ou un lien, l'aide financière soit de nature à encourager l'adaptation.
  **Recommandation 4.13**
- Si les transporteurs, services particuliers de transporteurs, terminaux ou liens ne deviennent pas viables après un délai d'adaptation raisonnable, que les services soient fermés ou interrompus.
  **Recommandation 4.14**

Pendant cette période d'adaptation, toute subvention restante financée par les contribuables sera :

- conçue, dans toute la mesure du possible, de manière à assurer le transport de la façon la plus efficiente possible, par quelque mode que ce soit;

- payée en puisant dans les recettes fiscales générales du palier de gouvernement qui prend la décision, et non par les autres usagers des transports; et
- programmée sur une période d'adaptation raisonnable et selon un barème dégressif aboutissant à zéro.
  **Recommandation 4.13**

La Commission royale reconnaît quatre cas pour lesquels les pouvoirs publics auront peut-être à verser des subventions transitoires : aéroports, transporteurs ferroviaires, autocars et traversiers. En conséquence, nous recommandons :

- Que dans les cas où l'application de nos principes aux aéroports, y compris tous les aéroports de Transports Canada, entraînerait de fortes hausses des redevances payées par les voyageurs, les pouvoirs publics offrent des subventions transitoires échelonnées sur dix ans. Le niveau initial de la subvention sera déterminé par le déficit d'exploitation actuel et servira à couvrir les dépenses d'équipement aussi bien que d'exploitation ou, si l'aéroport ferme ses portes, à d'autres fins de transport.
  **Recommandation 5.2**
- Que le gouvernement fédéral promulgue une loi donnant à VIA Rail un mandat de telle nature que la Société puisse fonctionner sur une base commerciale et établissant une disposition de temporisation sur dix ans de la subvention générale. Pendant cette période, VIA Rail disposera d'une plus grande liberté de décisions pour la direction de ses opérations, notamment en ce qui concerne l'investissement, le choix des lignes, les niveaux de service et les prix. Elle sera libre d'offrir d'autres services, sur une base concurrentielle, y compris des liaisons de banlieue et le transport de courrier, et elle sera tenue de déposer et de publier des plans d'exploitation et des rapports financiers annuels détaillés montrant les coûts et les recettes des lignes individuelles. Au bout de dix ans, toutes les lignes, exception faite des services aux régions éloignées, cesseront d'être subventionnées.
  **Recommandations 12.1, 12.2 et 12.3**

- Que, si besoin est, pour éviter de trop fortes augmentations des tarifs pratiqués par les compagnies d'autocar pour certains trajets, suite à l'assouplissement de la réglementation économique du secteur, les pouvoirs publics consentent des subventions transitoires selon un barème dégressif, étalées sur dix ans.
  **Recommandation 13.3**

- Que, si besoin est, pour éviter de trop fortes augmentations des tarifs, les pouvoirs publics versent à différents services de traversier des subventions transitoires, sur une période maximale de dix ans.
  **Recommandation 14.1**

Dans certains cas, les pouvoirs publics choisiront peut-être de maintenir les subventions à des services de transport des voyageurs qui ne sont pas viables. De telles subventions ne s'inscriraient pas dans notre cadre de référence et, de façon générale, ne devraient pas être maintenues. Cependant, si des gouvernements continuent de verser des subventions en dépit de nos recommandations, ils devront le faire de manière à ce que les services visés soient aussi efficients que possible. Par ailleurs, ce seront les contribuables, et non pas les voyageurs, qui paieront ces subventions.

Dans les cas où les pouvoirs publics jugeraient opportun de verser une subvention pour un service voyageurs à une localité isolée, nous recommandons :

a) que l'on utilise le mode et le transporteur le plus efficient et, chaque fois que cela est possible, que l'on lance un appel d'offres;

b) que toute desserte subventionnée en région isolée (quel que soit le mode) soit conçue de manière à ne transporter les voyageurs que jusqu'au point de correspondance commode le plus proche avec un service commercial non subventionné; et

c) que les subventions et leur justification soient soumises à l'examen du public.
**Recommandation 12.5**

Dans le cas de services de traversier visés par une obligation constitutionnelle, nous recommandons :

- Que le gouvernement fédéral s'efforce de recouvrer les coûts par une exploitation efficiente et une tarification optimale dans l'exécution de ses obligations constitutionnelles, ou alors qu'il offre à la province concernée une allocation tenant lieu de subvention. **Recommandation 14.2**

## Les coûts à l'échelle du système

Nous avons traité des changements que supposeront nos recommandations pour les voyageurs, les transporteurs, les fournisseurs d'infrastructure et les pouvoirs publics.

Étant donné que ce faisant nous avons été amenés à nous attarder sur des changements au niveau des coûts et des droits, il importe que nous examinions les coûts d'ensemble du système de transport des voyageurs d'aujourd'hui et de demain, une fois nos recommandations mises en oeuvre.

Les tableaux 2(a) et 2(b), «Coûts annuels des voyages interurbains intérieurs pour le système dans son ensemble, payés par les usagers et par les autres, 1991, en dollars de 1991», expliquent quels sont les coûts du système. Ces tableaux se trouvent dans le rapport *Directions*, volume 1, chapitre 3.

Le chapitre 18 de *Directions*, volume 1, reprend la discussion et illustre, grâce à des tableaux et figures, l'évolution que pourraient suivre ces coûts estimatifs si le statu quo était maintenu et la façon dont ils changeront une fois mises en oeuvre nos recommandations. Les tableaux 4, 5 et 6 reproduisent certaines de ces données.

*Tableau 4*

## ESTIMATION DES COÛTS ANNUELS DES DÉPLACEMENTS INTERURBAINS AU CANADA, SCÉNARIO STATU QUO 2000

Totaux : en millions de $, en dollars de 1991

| Types de coûts | Automobile (278 milliards de km-voy.) | | | Autocar (3,3 milliards de km-voy.) | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 0 | 5 769 | 5 769 | 0 | 10 | 10 |
| Environnement | 0 | 1 247 | 1 247 | 0 | 8 | 8 |
| Accidents | 9 213 | 202 | 9 415 | 12 | 0 | 12 |
| Taxes/redevances spéciales | 3 199 | -3 199 | 0 | 9 | -9 | 0 |
| Véhicules/transporteurs | 28 954 | 0 | 28 954 | 277 | 8 | 285 |
| **Total** | **41 366** | **4 019** | **45 385** | **298** | **17** | **315** |

| Types de coûts | Avion (33 milliards de km-voy.) | | | Train (1,4 milliard de km-voy.) | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 723 | 701 | 1 424 | 45 | 0 | 45 |
| Environnement | 0 | 266 | 266 | 0 | 9 | 9 |
| Accidents | 33 | 0 | 33 | 3 | 0 | 3 |
| Taxes/redevances spéciales | 165 | -165 | 0 | 6 | -6 | 0 |
| Véhicules/transporteurs | 4 127 | 0 | 4 127 | 99 | 435 | 534 |
| **Total** | **5 048** | **802** | **5 850** | **153** | **438** | **591** |

| Types de coûts | Traversier (1,1 milliard de km-voy.) | | | Voyages interurbains — Total (310 milliards de km-voy.) | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 0 | 52 | 52 | 768 | 6 532 | 7 300 |
| Environnement | 0 | 22 | 22 | 0 | 1 552 | 1 552 |
| Accidents | 1 | 0 | 1 | 9 262 | 202 | 9 464 |
| Taxes/redevances spéciales | 10 | -10 | 0 | 3 389 | -3 389 | 0 |
| Véhicules/transporteurs | 264 | 113 | 377 | 33 721 | 556 | 34 277 |
| **Total** | **275** | **177** | **452** | **47 140** | **5 453** | **52 593** |

**Nota :** Pour faire ressortir les plus petites composantes, les chiffres sont exprimés au million de dollars le plus près. En général, les évaluations de coûts ne sont pas exactes à ce niveau de précision.

*Tableau 5*

## ESTIMATION DES COÛTS ANNUELS DES DEPLACEMENTS INTERURBAINS AU CANADA — SCENARIO «DIRECTIONS» 2000

Totaux : en millions de $, en dollars de 1991

| | **Automobile (270 milliards de km-voy.)** | | | **Autocar (3,5 milliards de km-voy.)** | | |
|---|---|---|---|---|---|---|
| **Types de coûts** | Usagers | Autres | Total | Usagers | Autres | Total |
| **Infrastructure** | 5 491 | 0 | 5 491 | 9 | 0 | 9 |
| **Environnement** | 1 122 | 0 | 1 122 | 6 | 0 | 6 |
| **Accidents** | 9 414 | 0 | 9 414 | 12 | 0 | 12 |
| **Taxes/redevances spéciales** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Véhicules/transporteurs** | 28 480 | 0 | 28 480 | 237 | 5 | 242 |
| **Total** | **44 507** | **0** | **44 507** | **264** | **5** | **269** |

| | **Avion (33 milliards de km-voy.)** | | | **Train (0,7 milliard de km-voy.)** | | |
|---|---|---|---|---|---|---|
| **Types de coûts** | Usagers | Autres | Total | Usagers | Autres | Total |
| **Infrastructure** | 1 133 | 40 | 1 173 | 32 | 0 | 32 |
| **Environnement** | 253 | 0 | 253 | 4 | 0 | 4 |
| **Accidents** | 33 | 0 | 33 | 1 | 0 | 1 |
| **Taxes/redevances spéciales** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Véhicules/transporteurs** | 4 127 | 0 | 4 127 | 181 | 60 | 241 |
| **Total** | **5 546** | **40** | **5 586** | **218** | **60** | **278** |

| | **Traversier (1,1 milliard de km-voy.)** | | | **Voyages interurbains — total (310 milliards de km-voy.)** | | |
|---|---|---|---|---|---|---|
| **Types de coûts** | Usagers | Autres | Total | **Usagers** | **Autres** | **Total** |
| **Infrastructure** | 47 | 0 | 47 | **6 725** | **40** | **6 765** |
| **Environnement** | 17 | 0 | 17 | **1 405** | **0** | **1 405** |
| **Accidents** | 1 | 0 | 1 | **9 470** | **0** | **9 470** |
| **Taxes/redevances spéciales** | 0 | 0 | 0 | **0** | **0** | **0** |
| **Véhicules/transporteurs** | 320 | 28 | 348 | **33 411** | **93** | **33 504** |
| **Total** | **385** | **28** | **413** | **51 011** | **133** | **51 144** |

**Nota :** **Pour faire ressortir les plus petites composantes, les chiffres sont exprimés au million de dollars le plus près. En général, les évaluations de coûts ne sont pas exactes à ce niveau de précision.**

**Les coûts pour chaque moyen de transport ne correspondent pas, une fois additionnés, aux coûts de l'ensemble des voyages interurbains étant donné que le montant total comprend le coût de la multiplication des déplacements en automobile, en autocar et en avion pour remplacer la réduction des voyages ferroviaires entre les scénarios SQ 2000 et D 2000.**

*Tableau 6*

## ESTIMATION DES COÛTS ANNUELS DES DÉPLACEMENTS INTERURBAINS AU CANADA — CHANGEMENTS APPORTÉS PAR LE SCÉNARIO D 2000 PAR RAPPORT AU SCÉNARIO SQ 2000

Totaux : en millions de $, en dollars de 1991

| Types de coûts | Automobile | | | Autocar | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 5 491 | –5 769 | –278 | 9 | –10 | –1 |
| Environnement | 1 122 | –1 247 | –125 | 6 | –8 | –2 |
| Accidents | 201 | –202 | –1 | 0 | 0 | 0 |
| Taxes/redevances spéciales | –3 199 | 3 199 | 0 | –9 | 9 | 0 |
| Véhicules/transporteurs | –474 | 0 | –474 | –40 | –3 | –43 |
| **Total** | **3 141** | **–4 019** | **–878** | **–34** | **–12** | **–46** |

| Types de coûts | Avion | | | Train | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 410 | –661 | –251 | –13 | 0 | –13 |
| Environnement | 253 | –266 | –13 | 4 | –9 | –5 |
| Accidents | 0 | 0 | 0 | –2 | 0 | –2 |
| Taxes/redevances spéciales | –165 | 165 | 0 | –6 | 6 | 0 |
| Véhicules/transporteurs | 0 | 0 | 0 | 82 | –375 | –293 |
| **Total** | **498** | **–762** | **–264** | **65** | **–378** | **–313** |

| Types de coûts | Traversier | | | Voyages interurbains — total | | |
|---|---|---|---|---|---|---|
| | Usagers | Autres | Total | Usagers | Autres | Total |
| Infrastructure | 47 | –52 | –5 | **5 957** | **–6 492** | **–535** |
| Environnement | 17 | –22 | –5 | **1 405** | **–1 552** | **–147** |
| Accidents | 0 | 0 | 0 | **206** | **–202** | **6** |
| Taxes/redevances spéciales | –10 | 10 | 0 | **–3 389** | **3 389** | **0** |
| Véhicules/transporteurs | 56 | –85 | –29 | **–310** | **–463** | **–773** |
| **Total** | **110** | **–149** | **–39** | **3 871** | **–5 320** | **–1 449** |

**Nota :** Pour faire ressortir les plus petites composantes, les chiffres sont exprimés au million de dollars le plus près. En général, les évaluations de coûts ne sont pas exactes à ce niveau du précision.

Les coûts pour chaque moyen de transport ne correspondent pas, une fois additionnés, aux coûts de l'ensemble des voyages interurbains étant donné que le montant total comprend le coût de la multiplication des déplacements en automobile, en autocar et en avion pour remplacer la réduction des voyages ferroviaires entre les scénarios SQ 2000 et D 2000.

Par conséquent, une fois nos recommandations adoptées, il y aura non seulement transfert des coûts du contribuable au voyageur mais également des économies annuelles pour les deux en ce qui concerne la plupart des types de coûts de transport des voyageurs :

| | |
|---|---|
| • économie pour les contribuables et le grand public | 5,320 milliards $ |
| • augmentations des coûts pour les voyageurs | 3,871 milliards $ |
| • économies du coût total des déplacements des voyageurs | 1,449 milliard $ |

## RÉALISER NOS OBJECTIFS EN MATIÈRE DE TRANSPORT DES VOYAGEURS

Nous croyons que nos recommandations permettront l'établissement d'un système de transport des voyageurs sûr, respectueux de l'environnement, équitable à l'égard des contribuables, des usagers et des transporteurs et économiquement efficient.

**Premier objectif : une amélioration de la sécurité**

Nous sommes convaincus que lorsque voyageurs et transporteurs devront payer l'intégralité des coûts des accidents et des programmes de sécurité, ils changeront de comportement, ce qui réduira le nombre d'accidents. Nous nous attendons également à ce que la discipline requise pour faire une évaluation objective des risques et des mesures de sécurité pour assurer la reddition de comptes et la transparence dans la tarification encouragera les pouvoirs publics à traiter plus uniformément les différents modes, rentabilisant ainsi au maximum les sommes consacrées à l'amélioration de la sécurité.

**Deuxième objectif : une meilleure protection de l'environnement**

Nous croyons que nos recommandations amèneront une meilleure protection de l'environnement en convaincant les usagers de réduire les dommages qu'ils causent et en veillant à ce que ceux qui voyagent moins ne paient pas les coûts environnementaux infligés par ceux qui se déplacent plus. Tous les modes seront assujettis aux mêmes normes et redevances.

Même si nos recommandations visent des changements radicaux, nous croyons qu'elles sont rationnelles et justes et qu'elles permettront la réalisation efficiente et au moindre coût de l'ensemble des objectifs environnementaux nationaux.

**Troisième objectif : une plus grande équité envers les contribuables, les voyageurs et les transporteurs**

Nous croyons que les subventions versées par les contribuables et les usagers des transports à certains groupes de voyageurs sont injustes. Citons, à titre d'exemple, les voyageurs aériens qui bénéficient des systèmes de navigation aérienne et de services aéroportuaires financés par des non-voyageurs, et les voyageurs de train dont une partie du billet est payée à même des subventions directes versées par les contribuables. De telles subventions consenties à un mode sont injustes à l'égard des autres qui pourraient proposer des services concurrentiels.

La solution est simple. En vertu de notre cadre de référence, transporteurs et, en fin de compte, voyageurs, paieront l'intégralité des coûts de l'infrastructure et des services de transport. Cette solution s'appliquera également aux modes qui bénéficient d'importantes subventions, notamment les services ferroviaires voyageurs et les services de traversier qui ne sont visés par aucune obligation constitutionnelle.

**Quatrième objectif : un système de transport plus efficient**

Le système de transport des voyageurs sera rendu plus efficient, c'est-à-dire en mesure d'offrir un meilleur service à moindre coût, par une refonte de la structure de propriété, de la gestion, des politiques de tarification et de la prise de décisions en matière d'investissement.

Nous sommes convaincus que la concurrence encouragera l'innovation : compétition entre les modes, entre les transporteurs à l'intérieur de chaque mode et, le cas échéant, entre fournisseurs d'infrastructure.

## LE BOUT DU CHEMIN

Nos principes érigeront un cadre où les prix payés par les voyageurs refléteront les coûts et où les institutions seront flexibles et attentives. Ce cadre pénalisera les activités de transport qui deviennent trop coûteuses par rapport aux avantages qu'elles apportent et encouragera le secteur des transports à saisir les possibilités nouvelles offertes par les progrès technologiques et autres évolutions favorables.

Le présent résumé ne donne qu'un aperçu de nos conclusions et recommandations, et nous encourageons le lecteur à consulter *Directions*, notre rapport final. Nous pensons qu'une bonne connaissance de la façon dont fonctionne et est financé le système de transport des voyageurs, de son mode de gestion, de son régime de propriété et de la répartition des coûts vous convaincra qu'il est temps de changer les choses.

# Volume

# 1

# DIRECTIONS

## THE FINAL REPORT OF THE ROYAL COMMISSION ON NATIONAL PASSENGER TRANSPORTATION

Volume 1

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Royal Commission on
National Passenger
Transportation

CANADA

Commission royale sur le
transport des voyageurs
au Canada

*TO HIS EXCELLENCY*
*THE GOVERNOR GENERAL IN COUNCIL*

*MAY IT PLEASE YOUR EXCELLENCY*

*By Order in Council dated October 19, 1989 we were requested to inquire into and report upon a national integrated intercity passenger transportation system to meet the needs of Canada and Canadians in the 21st century and to ensure that transportation links among Canada's regions and communities are maintained and improved.*

*Having previously submitted an Interim Report in April 1991, we now beg to submit our Final Report in each official language.*

*Respectfully submitted,*

*Louis D. Hyndman, Q.C., Chair*

*Marie-Josée Drouin, Vice-Chair*

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# FOREWORD — OUR VISION

In the autumn of 1989, nine Canadians came together to face a unique challenge. Our mission: to establish guideposts for the passenger transportation system that Canadian travellers will use well into the next century and to develop sensible recommendations for the system's future.

Strangers at first, we came to blend our widely different life experiences and to merge into this report what we heard and learned from Canadians. We knew that passenger transportation was not just wheels and wings, terminals and stations. Rather, our topic was people — Canadians who want to visit friends and relatives, do business or enjoy a holiday.

Looking at the road ahead, the Commissioners thought about the unlimited horizons of our young people who increasingly travel this remarkable country. We pondered the trend of increasing numbers of seniors who pride themselves on remaining active and considered people with disabilities who also want to move about easily in terminals, and on and off airplanes, trains, buses and ferries. We shared the worries of Canadian taxpayers who, like us, want more choice, less government, top value for their travel and tax dollars and a voice in the transportation decisions that affect them.

Above all, as the Commissioners travelled extensively throughout the country and met with Canadians from all regions and all walks of life, we were impressed by the vastness and diversity of the land we call Canada and, more importantly, by the people who call it home. We believe there is something called the Canadian culture, the Canadian soul, the Canadian way of life, the Canadian vision. This Canadian uniqueness is worth preserving, whatever the difficulties.

We realize that while the transportation system no longer plays the nation-building role it once did, it nevertheless remains an important element in linking Canadians to one another.

And what about tomorrow? The Royal Commission on National Passenger Transportation has a vision for the future of Canada's transportation system and the role it will play in our daily lives. The journey begins now. . . .

The year is 2012. Canada is a respected and fully participating member of the global community. Efficient, productive and competitive, Canada's resources, products and brain-power are in demand worldwide.

Canada is envied for its sense of fairness and respect for human rights. Potential immigrants continue to look upon Canada as one of the most favoured lands of opportunity. Canada continues to rank at or near the top of the list of "quality of life" countries in the world.

The Canadian passenger transportation system is a model for the world in this year 2012. Canadians travel across the land using a system that is even safer than it was back in 1992. Sophisticated navigation systems enable planes to fly in weather that would have shut down the system back then. Car accidents and deaths have been reduced by on-board radar systems, automated traffic control, stronger but lighter car bodies — even some automatically driven cars. In some parts of the country, special car, truck and bus lanes speed up traffic and reduce congestion.

Canada has achieved an enviable balance between sensitivity to environmental damage and the other objectives of the transportation system. Responding to public opinion and efficient pricing over the last 20 years, the transportation sector now builds much cleaner cars, buses, trains, airplanes and ferries.

Half the new cars sold are electrically powered, or are hybrids using propane or natural gas with gasoline. Travellers must pay more when they travel on the few remaining carriers that still have dirty engines. Pollution costs are printed on the tickets travellers purchase, and comparisons of the amount of damage caused by each mode of travel are given wide publicity.

There have been few expropriations of land for new rights-of-way or for airports in Canada since 1992, because existing highways and terminals are used more efficiently. Agricultural land no longer disappears under asphalt and concrete.

Canadians are applauded around the globe for the priority they assign to the interests of people with disabilities. Today, in 2012, there are millions more Canadians over 60 than 20 years ago. People working in passenger transportation place priority on assisting those who have walking, vision or hearing disabilities, and terminal designs and travel announcements are user-friendly to all.

New-technology trains that pay for themselves are planned for or are in operation between Vancouver and Abbotsford, Edmonton and Calgary, and Windsor and Quebec City.

A new kind of government leadership emerged during the 1990s. Governments removed themselves from virtually all aspects of transport operations to focus on their new role as policy makers, referees and standard-setters. The government transportation staff undertaking these tasks has been reduced from 120,000 in 1992 to 20,000 today. Canadians feel they have more local control over their passenger transportation system.

Canadians also have access to the facts about their passenger transportation system and know that they can move around the country in the most efficient way, without waste or duplication. Choices abound in fares, departure times and comfort levels. Taxpayers know that the system pays for itself, while travellers know and accept that they pay for all the costs they impose upon the system when they travel. Those who do not travel know that they no longer pay taxes to support those who do. Only a few small subsidies remain; most were phased out during the 1990s. In short, Canadians have the system they want, get what they pay for and pay for what they get.

The further opening of competition brought in more airlines, more bus companies of all sizes, more alternatives on rail tracks and more ways to move over water. Terminals which also double as local shopping malls, business offices, exhibition halls and community centres are shared by different carriers and modes, and provide convenient connections to other terminals.

Equally important, taxpayers are satisfied knowing that rigorous benefit-cost studies are mandatory for all transportation project proposals and that existing roads and airports are well maintained and operate at maximum efficiency.

That is our vision for the future. It is achievable. The recommendations that follow — when applied — will bring it about.

Louis D. Hyndman, Q.C.
Chair

Autumn 1992

# ACKNOWLEDGEMENTS

On presenting *Directions: The Final Report of the Royal Commission on National Passenger Transportation* to the Governor in Council of Canada, I am reminded of one of the more popular works by John Donne, in which he says: "No man is an island, entire of itself." I am, therefore, sincerely pleased for this opportunity to express my thanks to the many people who made this report possible. It is the work of many hands.

Firstly, I express my heartfelt appreciation and gratitude to my colleague Commissioners. When nine people from diverse professional and personal backgrounds are appointed to work on a common project, it is only through the utmost good faith and personal commitment that the endeavour can succeed. That diversity, good faith and personal commitment among my colleagues have made this a rewarding and rich experience for me. For their candor, their sound advice and their friendship as Canadians, I will be forever grateful. I know that they join with me now in expressing the following thanks.

The formidable challenge of assisting and supporting nine Commissioners, as well as the overall responsibility for the management of the Commission's work and inquiry operations, fell upon Dr. Janet R. Smith, the Commission's Executive Director. Her exceptional organizational and management skills kept the Commission operating smoothly at all times and gave us the freedom to devote ourselves exclusively to the inquiry at hand. We have all benefited from her extensive and incisive knowledge of the transportation sector and of government, her practical working experience and her penetrating intellect. Janet was, for me, a knowledgeable counsel and forthright confidante.

Many staff members joined the ranks of the Royal Commission on National Passenger Transportation during its three-year mandate, and we are indebted to all of them. They were frequently called upon to go that "extra kilometre," and they always delivered on time. Their names appear in Appendix B. Some among them call for special mention.

United in loyalty and support to our mission was a professional and highly proficient senior management complement: John Sargent, Director of Research; Helen Hardy, Deputy Director of Research; Brian Johnson, Director of Policy and Planning; Denise Ommanney, Director of Public Consultation; Linda Bergeron, Director of Communications; Nina-Maria Butcher, Director of Administrative Services; and Sherry Hudon, Executive Assistant to Dr. Smith and Secretary to Senior Management Committee.

The task of recommending a transportation framework for Canada in the 21st century required counsel and advice from the leading researchers in several specialized fields, and we were fortunate to find the highest calibre of expertise in our consultants. Our sincere gratitude goes to all of those who contributed to the research program of our final report.

Since transportation systems are closely associated to countries, our mandate required us to consult with our international transportation counterparts. We needed to observe first-hand the roles that their passenger transportation systems are playing and to evaluate how the solutions advanced by other countries to concerns similar to our own might apply to the Canadian experience. These international consultations expanded and enriched the context of our final report, and we would like to express to all whom we consulted our appreciation for their willing and frank exchange of information. We also want to thank Transport Canada and External Affairs and International Trade Canada for their helpful assistance in organizing these international exchanges.

Still on the consultation front, we wish to voice our deepest gratitude to all those Canadians who came forward during the public hearings and throughout our mandate to communicate their opinions and concerns about Canada's passenger transportation system. We heard from people with disabilities, business, labour, governments, seniors, young people and interested citizens. Commissioners were moved by the personal accounts of so many individuals who spoke and wrote to us about their experiences with the present transportation system. We were also impressed with the hope that Canadians have for a better system in the future. The best testimonial that we, as a Royal Commission, can offer these Canadians is to show them that we heard and listened to what they had to say: they will find many of their views and concerns addressed throughout the pages of this report.

The production of a comprehensive four-volume final report, especially one that deals with highly technical data, demands the finest quality of writing, revision, editing and translation. Commission staff, assisted by a team of professionals, strived to maintain not only a high quality of language and to keep the text readable for all Canadians. We thank Nadja Corkum and Claire Harrison of Astroff Corkum Ross Associates Inc. for their writing and editorial assistance with the English text, and Volker Junginger and Christine O'Meara of Tradunion Inc. for their translation and revision of the French version.

I would also like to express a personal note of thanks to Estelle Lord, my Administrative Assistant in Edmonton, for her loyal dedication and competent service.

And, finally, we acknowledge the patience of our families, who have endured our many absences from home during the work of this Royal Commission. Because of their support and understanding, we ask that they share in our pride and accomplishment.

Louis D. Hyndman, Q.C.
Chair

Autumn 1992

# CHAPTER 1

# POINT OF DEPARTURE

## SETTING THE STAGE

In October 1989, the Government of Canada asked us to "inquire into and report upon a national integrated intercity passenger transportation system to meet the needs of Canada and Canadians in the 21st century."[1]

### CHANGES IN THE WORLD COMMUNITY

During the three years of our mandate, we have witnessed unexpected and often dramatic changes in Canada and other countries. When we began our task in 1989, the great changes that have since swept Central and Eastern Europe and the subsequent redrawing of the political map had yet to occur. In Canada, the Meech Lake Accord appeared to be on its way to ratification. The Free Trade Agreement with the United States had been approved months earlier, and the North American economies were strong and growing.

Today, the U.S.S.R. is gone, and its successor states and the countries of Eastern Europe are struggling toward market economies. The General Agreement on Tariffs and Trade (GATT) is being challenged by the failure of its members to deal with the increasing competitiveness of modern economies in a wide array of sectors, from agriculture to intellectual property to services in general. The North American economies are battling a lengthy recession compounded by major economic restructuring. At the time of writing, Canadians are assessing, in a fundamental way, the nature of their country — by redefining national institutions and rethinking their approach to federalism.

Transportation around the world is also undergoing major change. Rail traffic in Eastern Europe has decreased as car sales have increased. The world's airlines have been hurt by recession and the 1991 Gulf War — many failed, others merged or were sold. Growing environmental problems are prompting increased public awareness of the need for global action in transportation and other sectors. The benefits of loosening government controls over the delivery of services are resulting in new approaches to meeting travellers' needs. Many countries are trying new ways to finance transportation infrastructure privately and to privatize government transportation services. We believe that this rapid pace of change will continue. Canadians cannot ignore these changes in other parts of the world, and the challenges that they present.

## WHY IT IS IMPORTANT TO MAKE THE RIGHT PASSENGER TRANSPORTATION DECISIONS

In total, Canadians in 1989 devoted substantially more resources to transportation than they did to health care — equivalent to 16 percent of gross domestic product (GDP) compared with 9 percent of GDP, respectively. Resources used to provide intercity passenger transportation accounted for 30 percent to 40 percent of total resources devoted to transportation, or 5 percent to 7 percent of GDP (depending on how extensively "intercity" travel is defined, particularly travel by private car).[2] This is an annual expenditure of $30 billion to $45 billion or $1,100 to $1,700 per Canadian. As the economies of nations become more and more interdependent, the choices that Canadians make about passenger transportation projects and investment will affect Canada's economic success in the global marketplace.

Revolutions in communications technology are changing the way businesses operate and are encouraging globalization of markets.[3] For example, the production, marketing and financial systems of large multinational corporations are increasingly integrated on a global basis. In the future, the quality of life in all countries will depend on their ability to adjust to a world in which there are fewer national barriers to the movement of capital, labour, goods and services.

Many sectors of the Canadian economy, such as the tourism industry and manufacturers who sell goods and services abroad, depend on the transportation system to provide cost-effective service so that they, in turn, can better serve their customers. Passenger transportation companies must look for ways to improve services and lower prices.

### PUBLIC CONCERNS OVER PASSENGER TRANSPORTATION

On most trips taken, no matter by which mode, the taxpayer is often an unwitting partner. Travellers want more and improved passenger transportation services, but taxpayers are increasingly reluctant to bear the consequent financial burden. Some Canadians travel frequently and use the passenger transportation system extensively. Others travel seldom, or not at all, yet their taxes help pay for those who do travel. Even if current budgetary pressures abate, the public will continue to pressure the government to spend wisely — by maintaining the passenger transportation system when funds are limited and not over-building it when funds are plentiful.

Concerns about how transportation affects the environment have moved to the fore. Transportation leads to traffic congestion, causes air and noise pollution, and consumes land for roads, airports and parking lots. As Canadians become more aware of the impact of transportation on human health and the long-term well-being of the planet, environmental issues are becoming a more important factor in passenger transportation decisions. Governments at all levels face growing public pressure to regulate the transportation sector for greater protection of the environment.

## OUR ACTIVITIES

In the course of our three-year mandate we consulted with Canadians, studied passenger transportation in other countries and undertook a research program.

## CONSULTING WITH CANADIANS

Through public hearings, written submissions, toll-free telephone lines and consultations, we listened to Canadians who have an interest in passenger transportation. These included travellers and providers of transportation infrastructure and services, as well as governments, taxpayers, unions and regulators.[4] We wanted to understand the needs and aspirations of travellers, to ascertain the concerns of those who provide passenger transportation infrastructure and services, and to identify the issues and problems.

## STUDYING PASSENGER TRANSPORTATION IN OTHER COUNTRIES

We also looked at how other countries are dealing with passenger transportation issues. Rapid political and economic change is affecting many nations, and we discovered that Canada is not alone in questioning the traditional ways of making passenger transportation policy and investment decisions, nor in seeking new ways to resolve transportation issues. Governments around the world are exploring ways to improve the efficiency of their transportation systems.

Several countries have recently undertaken major transportation studies, and some are already putting recommendations into practice. The United States, Switzerland, Sweden, and The Netherlands are approaching transportation issues from a broad perspective. They have developed, and are beginning to implement, long-term strategies that deal comprehensively with the issues in all transportation modes.[5] Other countries have undertaken studies that focus on specific problems and modes. Australia and Germany have examined escalating deficits and other issues in the rail sector.[6] Australia has been studying, and changing, road user-charges and air transportation regulation. New Zealand has made major changes in the way it provides roads and charges road users.

Many countries have relaxed government controls and economic regulation over their passenger transportation carriers. The United States, Australia, New Zealand and the United Kingdom view transportation less as an instrument of public policy and more as an economic activity that can benefit from the tests, economic discipline, creativity and incentives of the market. Many countries are studying ways of setting prices that reflect the costs of transportation services and infrastructure:

- In the United States, a government report is explicit about the need to "assure that transportation users bear the maximum practical and appropriate share of the costs of services and facilities they use."[7]
- In Sweden, legislation emphasizes that transportation prices to travellers must include the costs of pollution, congestion and traffic accidents.[8]
- In Norway, an extensive toll system exists around Oslo city centre, and drivers using downtown streets must pay a charge that is intended to discourage city driving.
- In Singapore, city traffic is controlled through an area licensing scheme. Authorities auction limited numbers of special licences that all vehicles must have when entering and operating within the restricted zone.

Several countries are experimenting with alternative transportation ownership and administrative arrangements:

- In 1986, the Australian government transferred the responsibility for planning and operating the country's major airports to a Federal Airport Corporation.
- New Zealand established Transit New Zealand — a quasi-autonomous authority — to manage its roads, and the revenues from road-user charges were earmarked to cover the expenditures of the road authority.
- In 1987, the United Kingdom privatized its main airports, transforming the government-owned British Airports Authority into a private-sector company.

- In France, Italy and Spain, extensive systems of toll highways operate under private or mixed private-public ownership.
- Germany and the United Kingdom have announced plans to privatize their government-owned railway companies.
- A number of other countries are inviting private firms to participate in the development, financing, construction, maintenance and operation of roads, bridges and tunnels, such as the Channel Tunnel between the United Kingdom and France.

## RESEARCHING INTERCITY PASSENGER TRANSPORTATION IN CANADA

Through our research program, we examined many aspects of intercity passenger transportation: how and where Canadians travel, the costs and who pays them, the safety of each mode, and the extent to which transportation affects the environment. We continued throughout our mandate to consult with travellers, providers of passenger transportation infrastructure and services, government officials and experts in Canada and abroad. We used our research and consultations to sharpen our understanding of the issues.

We concluded that the way the transportation system in Canada is managed is no longer adequate, for the following reasons:

- Governments often make passenger transportation decisions based on conflicting objectives.
- Although some travellers pay fully for their transportation, most travellers do not, and in no mode of travel are costs fully covered by fares, licences and fees paid by those who use the mode.
- Individual carriers face different rules and regulations. For some carriers, competition is the driving force; others operate as monopolies.
- Prices rarely reflect the costs of a traveller's use of the transportation system. As a result, travellers from well-used parts of the system help pay for parts that are used less often.

- Passenger transportation costs are sometimes higher than necessary because governments have not always invested in projects that yielded the highest positive return.
- Governments, industry and travellers rarely give full weight to the environmental and other social costs of transportation.
- Taxpayers do not have enough information about why particular decisions are made, or how their tax dollars are spent.

## OUR APPROACH

We have taken a long-range, comprehensive view of the passenger transportation system. Our program of study, consultation and research gave us a unique opportunity to step back from current day-to-day issues and view the passenger transportation system through a wider lens than that used by those who must deal daily with transportation problems. We want to help resolve not only today's issues and problems, but those of tomorrow as well.

### OUR METHOD

From the start, we wrestled with two ways of accomplishing our task. One method was to address, individually, the hundreds of problems facing today's passenger transportation system. We could have approached our task by listing the current passenger transportation issues, attempting to resolve them, and then looking for consistency and coherence in our solutions.[9] But we believe this method alone would fail, because such solutions would not be based on a long-term goal nor on clear objectives. The result would likely be passenger transportation recommendations that were inconsistent, short-term and wasteful.

The second method was to develop a long-term passenger transportation framework. We believe that the framework (the laws, regulations and institutions that govern transportation) must be developed by setting a goal and developing objectives that Canadians agree upon.

With a guiding framework in place, future passenger transportation decisions will be coherent, consistent and less expensive after all costs paid by all parties are taken into account.

## OUR DIRECTIONS

The directions that we recommend in this report, when followed, will not just mirror but will be in the forefront of the evolution of passenger transportation policy worldwide. Our recommendations will result in:

- a passenger transportation system that is safe;
- a passenger transportation system that protects the environment;
- a fairer passenger transportation system in which the costs would be paid by the people who benefit;
- a less expensive system where all costs are taken into account, with services better matched to traveller demand; and
- lower general taxes, resulting from lower total costs and the transfer of costs from the taxpayer to the traveller.

## OUR GUIDING PHILOSOPHY

We looked at two possible underpinnings for a passenger transportation framework — a subsidized transportation system and a traveller-funded transportation system.

Subsidized transportation results in lower prices for the traveller but higher taxes for citizens, whether they travel or not. We considered this option carefully, because it is similar to those used by governments in the past. For example, building the Canadian Pacific Railway (CPR) in the 1880s and developing the airline industry in the 1940s involved taxpayer expenditure. Today, however, transportation systems are reasonably well developed, and governments and industry must spend more on maintenance of the existing system than on new infrastructure. What was appropriate for a system in the process of development is not appropriate for one that is mature.

Some Canadians who spoke with us argued that a transportation system massively supported by the general taxpayer would make Canada more competitive internationally by lowering the costs of transportation as part of doing business. We found, however, that heavily subsidized transportation in other countries resulted in skewed business investments and activities, and inefficient, uncompetitive economies. For example, transportation in Eastern Europe and South America was, until recently, heavily subsidized, with no real improvement in prosperity and productivity. Even countries in the European Community are now assessing the results of large subsidies to their rail systems.

We believe that, unless our transportation system is made efficient now, Canadians will pay dearly later for the adjustments needed to survive in the global marketplace. We have chosen to build a framework on the basic philosophy that transportation should be provided through a system supported and maintained by its users and not through government departments and central controls. We see the transportation sector as requiring a different approach from such government-supported and controlled sectors as health and education, and relate it more closely to providers of services such as telecommunications and electric power. Transportation would lose its tax-supported base and transportation infrastructure and services would be provided according to the willingness of travellers to pay for them.

## THE PAST AND THE FUTURE

The passenger transportation policies of the future would not mirror those of the past. In particular:

- In the past, government has regulated the economic aspects of passenger transportation systems and has provided much of the infrastructure. We believe these systems should be open and accessible, and that government should confine its role to being a referee and policy setter.
- In the past, jurisdiction over passenger transportation has often been divided in an inconsistent and contradictory way among levels of government. We believe that responsibilities should be assigned to the lowest level of government that can efficiently handle them, be that municipal, regional, territorial, provincial or federal, or a combination of these.
- In the past, the passenger transportation system has depended on funding from taxpayers whether they travel a little, a lot, or not at all. We believe that the passenger transportation system is now sufficiently mature to be self-sustaining, so that travellers should pay for what they get and get what they pay for.
- In the past, governments have made passenger transportation decisions without sufficient accountability to those who pay taxes or user fees. We believe that passenger transportation decisions should be visible and understandable and that all costs should be made public. The transportation system should be transparent in its accounts and accountable in its decision making.

We recognize that moving the transportation system out of government control right away would have major implications for industry and travellers. We therefore suggest transition periods to allow the passenger transportation system to adjust to being more autonomous, more accountable, more economically viable and more protective of the environment. These transition periods should be short and must not be an excuse for inaction or delay in the implementation of our recommendations.

## MOVING FORWARD

In the chapters that follow, we develop a passenger transportation framework for the future and make recommendations that implement it. We have organized this Report as follows:

- Chapter 2 presents a view of the Canadian passenger transportation system — past, present and future.
- Chapter 3 looks at the costs of the current passenger transportation system and who pays the costs.
- Chapter 4 discusses the principles underlying our framework. We make recommendations on a goal and on objectives for the passenger transportation system. We discuss the implications for governments, travellers, taxpayers, carriers, and providers of infrastructure. We also address transition mechanisms.
- Chapters 5 to 15 apply our principles to the existing passenger transportation system, addressing environmental, safety and accessibility issues, and analyzing the implications of our principles for each of the different modes.
- Chapters 16 and 17 address special transportation concerns — accountability, transparency and international issues.
- Chapter 18 examines changes in who will benefit from the new framework and who will pay.
- Chapter 19 summarizes the changes in legislation, regulations and institutions necessary to implement the framework and describes how these changes will meet our objectives.

We sought — and believe we found — Canadian solutions to Canadian problems. These proposals will lead to a significantly improved passenger transportation system that will encourage competition, creativity and technological change, will give most Canadian travellers the widest array of choices, and will ensure that non-travelling Canadians do not have to pay the bill for those who do.

# ENDNOTES

1. See Appendix A, Volume 1 for full Terms of Reference.

2. These figures correspond to comprehensive measures of the resources used to provide transportation, health, and intercity passenger transportation. In the case of transportation, they include both services used directly by consumers and governments, and services that are used by businesses to produce non-transportation goods and services. Our measure covers transportation services provided by commercial carriers (indicated by their revenues), and transportation "produced directly" by the user. Private purchases of cars and car operating expenses are used as an indicator of the personal component of direct production. The costs of government-provided transportation infrastructure (not already reflected in charges to travellers included in carrier revenues) are included in the operating costs of those providing their own transportation services.

   The low end of the estimated range of resources devoted to intercity travel defines "intercity" trips as trips longer than 80 kilometres in one-way distance. The high end of the range defines intercity trips as all trips by air, rail (excluding urban transit), intercity bus, ferry (apart from urban and short river crossing ferries) and all car travel on provincial highways. When comparing the roles of the different means of transportation, especially in chapters 2 and 10, we are guided by the narrower definition. In chapters 3 and 18, where an important element is the costs of different types of infrastructure, we use the wider definition.

   A different approach to measuring the "size of the transportation sector" is to include only the value added of transportation carrier industries, which is, for all transportation (freight and passenger, urban and intercity), about 4 percent of GDP. By comparison, the value added in the health care services, hospital and pharmaceutical industries is 7 percent of GDP.

   For a more complete discussion, see Notes to Chapter 1 and Notes to Chapter 2 in Volume 2 of this report.

3. Over the past two decades, the volume of world merchandise trade has been growing more rapidly than that of world output. And, during the 1980s, world outflow of foreign direct investment grew much more rapidly than world merchandise trade. Source: Economic Council of Canada, *Pulling Together: Productivity, Innovation and Trade* (Ottawa: Supply and Services Canada, 1992).

4. For a full discussion of what Canadians told us, see Chapter V of *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, 1991).

5. The Swiss government created the 62-member Federal Commission for a Swiss Integral Concept of Transport in 1972, whose report — *Rapport Final sur les travaux de la Commission féderale de la conception globale Suisse des transport* — was published in 1977. Sweden published its *Transport Policy for the 90s* in 1988. The United States released its major transportation review, *Moving America*, in 1990. The Netherlands developed its *Second Transport Structure Plan* in 1990.

6. The report of Australia's Industry Commission, entitled *Rail Transport*, was released in October 1991, roughly at the same time as that of the Government Commission on German Railways.

7. The U.S. policy statement is found in *Moving America*, p. 56.

8. *The Transportation Act, 1979* and *Transportation Act, 1988*.

9. See *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation*, pp. 159-162 (Ottawa: Supply and Services Canada, 1991).

# CHAPTER 2

# CANADIAN PERSPECTIVES: PAST, PRESENT AND FUTURE

## INTRODUCTION

Our inquiry is timely. The world is changing and Canada is changing with it. These changes present opportunities and challenges to those who will be making transportation decisions today and for the future. We firmly believe that our recommendations will help them choose well.

How can Canada take advantage of these opportunities and meet the challenges? Some guidance is found by examining the historical forces that shaped Canada's passenger transportation system, and by studying the current trends that will affect the transportation system in the future. Therefore, in this chapter, we examine the past, describe the passenger transportation system of today, and explore the possibilities for the passenger transportation system of tomorrow.

## AN HISTORICAL PERSPECTIVE

Early colonists used lakes and rivers as natural highways into the interior of the country. In the 18th century, the earliest forms of water transportation, such as canoes, were supplemented for commercial purposes with schooners and flat-bottomed boats. Early in the 19th century, the introduction of the steamship brought formalized, mostly privately owned, marine passenger transportation with regular schedules, set fares and different classes of accommodation.

From the 19th century to the middle of the 20th century, governments and industry built the transportation infrastructure that was needed to support Canada's developing economy. As new forms of transportation were introduced, new types of infrastructure were developed:

- In the 19th century, the Welland, Lachine and Rideau canals were constructed, and thousands of miles of railway track were laid.
- By 1885, the first transcontinental railway was completed. The laying of railway tracks continued at a rapid pace into the second decade of the 20th century.
- In the 1920s, the popularity of the car spurred the development of roads. Road building continued for several decades, including the construction of the Trans-Canada Highway from 1949 to 1965.
- Also in the 1920s, commercial air services were introduced. In the 1950s, their growth led to the development of new airports, and the modernization of air navigation and air traffic control systems.

## PAST ROLES OF GOVERNMENT

Early in Canada's history, governments considered the building of canals and laying of railway tracks to be private-sector enterprises. Many large-scale projects, however, turned out to be expensive and not commercially viable. Gradually, governments became involved in the financing, ownership and management of transportation infrastructure and services. Governments often stepped in with financial assistance in the form of subsidies, loans and loan guarantees to make the projects viable for private-sector investors.

Public support assisted the Canadian Pacific Railway Company (CP) in constructing the transcontinental railway. To attract a private syndicate to undertake construction, the federal government offered land grants of 25 million acres (10 million hectares), a cash subsidy of $25 million (equivalent in today's dollars to 15 to 20 times this much or $350 million to $500 million), and a series of privileges (including the promise of a 20-year monopoly on traffic in the area between the main line and the U.S. border). With government support, a successful railway company developed that still operates today.

Despite government financial assistance, the private sector often failed. Government had to assume ownership of the privately owned Welland and Lachine canals to keep these services operating. Also, many private railway companies overextended themselves. In 1919, the federal government consolidated many of these railways under the control of the Canadian National Railway Company (CN).

Provincial governments began to invest in road development in the 1920s, and road building continued through make-work projects during the Depression of the 1930s. Following World War II, a surge in car sales and the growth in truck transportation led to pressures for more road paving and modernization. During this period, road construction and maintenance became a major area of spending by provincial governments.

Federal government involvement in transportation increased during World War II as the development of air services was added to the earlier roles in marine and rail services. After the war, the federal government played a major role in the financing of air infrastructure by building airports, expanding the air navigation system and assuming ownership of many airports. Between 1951 and 1961, federal capital spending on air services increased nearly ninefold. The federal and provincial governments also participated jointly, for the first and only time in a major transportation project, in the construction of the Trans-Canada Highway.

Governments also controlled passenger transportation carriers. Throughout this period of expansion, federal regulations governed air and rail carriers and provincial or territorial regulations governed car, truck and bus operators. These regulations controlled almost every economic aspect of passenger transportation, including starting a business in the industry, choosing routes, setting fares and establishing standards for service.

By regulating the industry, by owning carriers (such as CN and its subsidiary, Trans-Canada Airlines, established in 1937) or by combining ownership and regulation, governments used transportation services to further various public policy objectives. They believed that the profits generated in some passenger transportation markets should subsidize other, unprofitable markets.

## CHANGING ROLES OF GOVERNMENT

By the early 1960s, governments began to study the effects of early transportation policies. During the 19th and early 20th centuries, the focus was on developing and building Canada's transportation system. By 1960, governments began to examine the transportation system in a different way. Although there were still areas where they felt new government investment was required to expand and upgrade infrastructure, the main modes and routes of transportation were now well established and the passenger transportation system had matured.

In 1961, the MacPherson Royal Commission on Transportation reported on the freight railway transportation system. It criticized government policies that hampered the railways' abilities to compete with other modes in the transportation of freight. Although the MacPherson Royal Commission's range of study was narrow, its conclusions had implications for transportation well beyond that of the freight railway system. Its findings influenced the 1967 *National Transportation Act* (NTA), the first federal transportation law that encompassed all modes of transportation. The new Act emphasized the need for competition between the air, rail, truck and bus modes to help achieve an "economic, efficient and adequate transport system."[1]

While the 1967 NTA promoted competition among modes, it did not eliminate economic regulatory restrictions on competition within modes. Air and water carriers, along with rail, truck and bus operators, were still subject to strict economic regulation.

In the 1970s and early 1980s, governments came under increasing pressure to relax many of these economic controls. The United States substantially reduced economic regulation in its transportation sector, and Canadian travellers and shippers pushed for reforms that would provide them with the same low costs as those experienced by users of the transportation system in the United States.

In response, the Government of Canada introduced a number of reforms in the late 1970s and early 1980s, and enacted the *National Transportation Act, 1987* (NTA, 1987). This Act declared that "a safe, economic, efficient and adequate" system is most likely to be achieved when "all carriers are able to compete both within and among the various modes of transportation." The major impact of this legislation on passenger services was on one mode only; it virtually eliminated entry, exit and price controls on the domestic airline industry. In addition, the federal government privatized Air Canada in 1988 and 1989.

The federal government also enacted the *Motor Vehicle Transport Act, 1987*, which resulted in a gradual dismantling of provincial regulatory controls over the trucking industry. Provincial governments continue to regulate intercity passenger buses, although New Brunswick and Prince Edward Island have recently eased entry requirements, and Alberta has opened entry to charter bus operations to anyone who can meet a minimal "fit, willing and able" test.

Many of the recommendations of the 1961 MacPherson Royal Commission, which emphasized the need for governments to repeal regulations and allow more competition in transportation, were implemented over 30 years.

## CANADA'S PASSENGER TRANSPORTATION SYSTEM TODAY

Intercity passenger transportation today is big business. We estimate that, in 1989, spending on intercity passenger transportation by Canadian travellers and taxpayers was in the $30 billion to $45 billion range, (depending on how extensively "intercity" is defined, especially as regards travel by car[2]). This figure includes passenger services on intercity carriers, the intercity portion of car use including car purchase costs, and the portion of government spending on the infrastructure component of the system.

Intercity passenger transportation provides employment to many Canadians. In 1991, intercity passenger carriers employed some 70,000 people and many more Canadians worked on related aspects of the transportation system. For example, they constructed and maintained roads, airports, and the air navigation system; they built and serviced cars, trucks and buses; and they produced and sold the oil, gas and parts used by the transportation sector. Governments, at all levels, are major employers in the system, as owners and providers of transportation infrastructure and services. They also employ smaller numbers of people in regulatory and policy functions. For example, Transport Canada employs approximately 21,000 people, and all governments — federal, provincial, territorial and municipal — employ approximately 100,000 in transportation and communications.[3]

Intercity passenger transportation is a complex system of interrelated components. Passenger transportation consists of the road, air, rail, and water modes of travel. It can be divided into two components:

- carriers that provide bus, airplane, train and ferry services together with privately owned passenger vehicles — cars, light trucks and vans (for ease in this report we refer to these vehicles as cars); and
- infrastructure that consists of the terminals where carriers start and stop, the "links" over which carriers operate, and the traffic control systems that direct the behaviour of carriers.

Table 2-1 illustrates the components of the transportation system.

The intercity passenger transportation system is connected to urban transportation systems and there is no clear boundary between traffic that occurs between cities and that which takes place within cities. It is also often the same system that carries freight.

*Table 2-1*
*COMPONENTS OF THE TRANSPORTATION SYSTEM*

| | | **Infrastructure** | | |
|---|---|---|---|---|
| **Mode** | **Carrier** | **Terminals** | **Links** | **Traffic control** |
| **Road** | Cars | Car parking | Roads (including bridges) | Police, road signs and signals, traffic control laws and regulations |
| | Buses | Bus terminals | | |
| **Air** | Airplanes | Airports (including runways) | Air navigation systems | Air traffic control |
| **Rail** | Trains | Stations | Railway tracks | Dispatch, signal systems |
| **Water** | Ferries | Ferry terminals (including wharves and ferry slips) | Waterways and canals (including navigational aids) | Vessel traffic services |

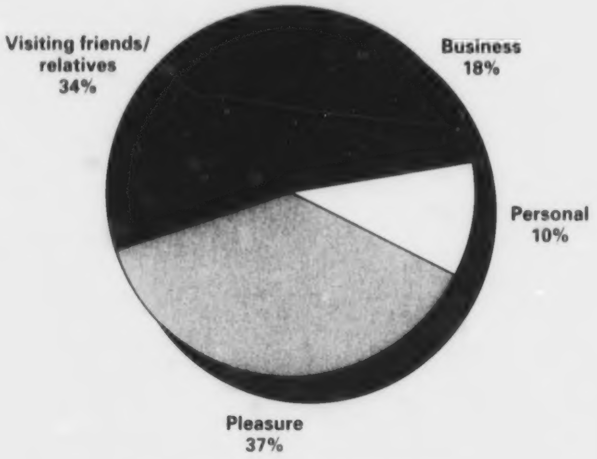
## WHY CANADIANS TRAVEL

Intercity passenger transportation is an important part of Canadian life. Passenger transportation enables Canadians to pursue private and business goals. It connects region to region and city to city, providing people with the opportunity to meet for business, visit friends and family, or expand their horizons. In 1990, Canadians took over 150 million intercity trips, of which 134 million were within Canada, an average of five trips per Canadian.[4]

Most Canadians who travel do so for vacations, sightseeing and to visit friends and relatives. Business travel accounts for a small share of intercity travel within Canada (Chart 2-1).

Most intercity trips in Canada are over short and medium distances and occur within, rather than between, provinces or territories. In 1990, 76 percent of trips taken were between 80 and 320 kilometres one way (Charts 2-2 and 2-3). However, one-way trips over 320 kilometres account for over 60 percent of passenger-kilometres travelled.

*Chart 2-1*
*DOMESTIC INTERCITY TRAVEL BY MAIN PURPOSE OF TRIP, 1990*



**Total: 133.8 million person-trips**

**Source:** Statistics Canada, *Touriscope: Domestic Travel 1990*, Catalogue No. 87-504, October 1991, p. 27.

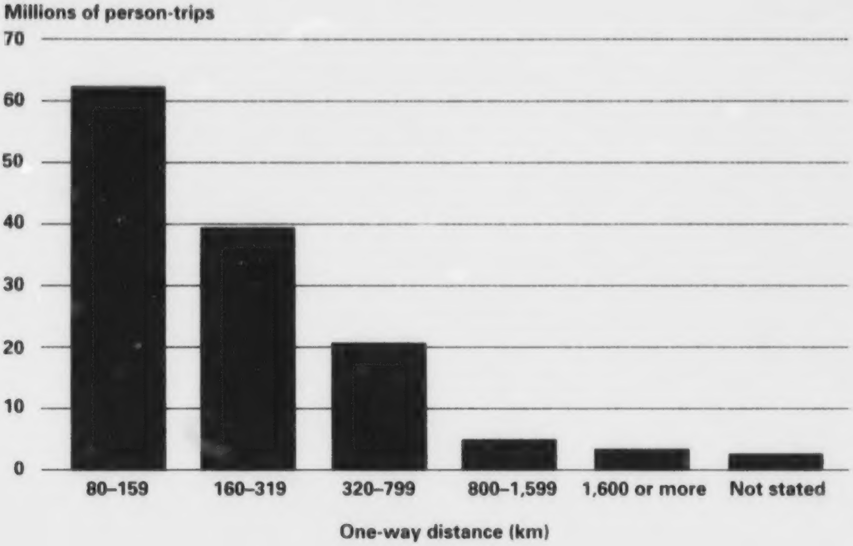
**Note:** Total person-trips include a "not-stated" category.

## HOW CANADIANS TRAVEL

The car is the favourite mode of intercity travel for Canadians, as well as for citizens of all the other developed Western countries. In 1990, around 80 percent of all domestic intercity[5] passenger-kilometres travelled in Canada were by car. Although the car is used for only a small proportion of trips over 3,200 kilometres, it is the most popular means of travel in all other distance categories (Chart 2-3).

For Canadians, the car is also the most popular means of international travel (mostly to the United States), although 35 percent of all international trips are by air (Chart 2-4). International car travel is popular because the United States is, by far, the chosen destination

*Chart 2-2*
*DOMESTIC INTERCITY TRAVEL BY DISTANCE OF TRIP (ONE-WAY), 1990*



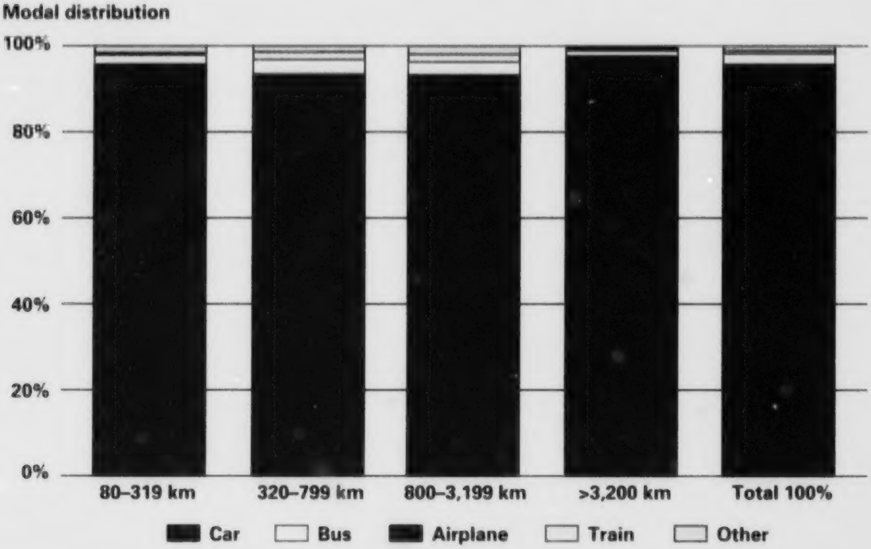
**Source: Statistics Canada, *Touriscope: Domestic Travel 1990*, Catalogue No. 87-504, October 1991, p. 27.**

of Canadians travelling outside the country. In 1990, 85 percent of all international trips taken by Canadians were to the United States. As with domestic travel, most international travel by Canadians is for vacations and to visit friends and relatives, rather than for business.

In terms of ways to travel, Canadians' choices have remained rather stable over time. As Chart 2-5 shows, the car has been the dominant mode of passenger transportation since 1930, except during World War II. Airplane travel has grown in importance since its beginning in the 1930s, and has become the dominant public mode of travel. The relative importance of bus and train travel has declined over the last 50 years.

*Chart 2-3*

***DOMESTIC INTERCITY TRAVEL BY MODE AND TRIP LENGTH, 1990***



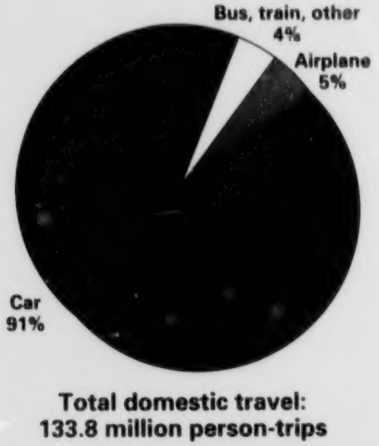
**Source:** Unpublished data from Statistics Canada's Canadian Travel Survey.

**Note:** "Other" category includes boat, motorcycle, bicycle, and means not specified by survey respondent.

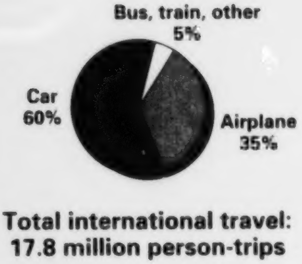
Canadian travel patterns differ from those of some countries but not in the strong attachment Canadians have for cars. As shown by the international comparative data in Chart 2-6 and Table 2-2, the car is now almost as important a mode of transportation in the United Kingdom and (the former West) Germany as it has been in Canada and the United States for decades. In France and Italy, the car is also the dominant mode. In all these countries, car use has increased

Chart 2-4

DOMESTIC AND INTERNATIONAL INTERCITY TRAVEL BY PRIMARY MODE, 1990



Total domestic travel:
133.8 million person-trips



Total international travel:
17.8 million person-trips

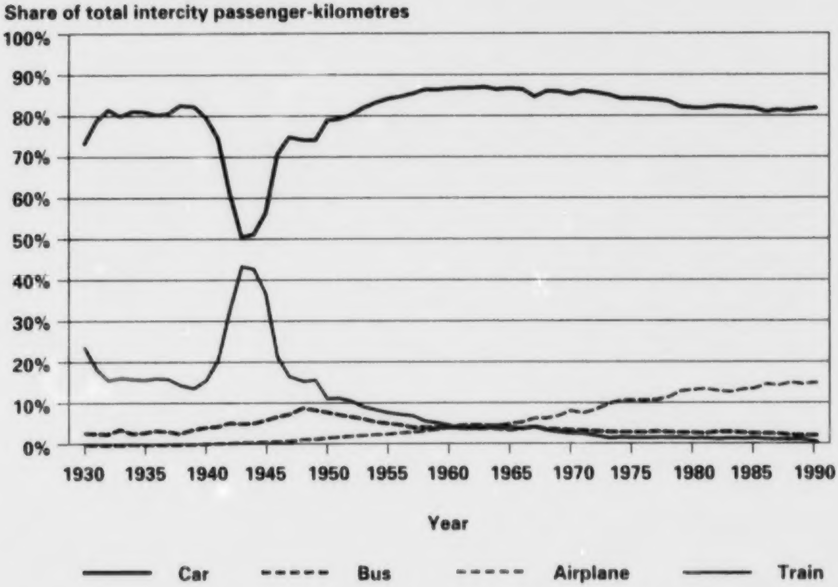
Sources: Domestic travel: Statistics Canada, Touriscope: Domestic Travel 1990, Catalogue No. 87-504, October 1991, p. 27.
International travel: unpublished figures from Statistics Canada's Canadian Travel Survey.

Note: "Other" category includes boat, motorcycle, bicycle, and means not specified by survey respondent.

appreciably over the past quarter of a century. In Japan, car use is also growing, although train travel continues to be more important than in Canada and the United States. Train travel also continues to play a somewhat larger role in Western Europe. Most countries, however, are experiencing the same long-term decrease in the importance of the bus and train travel that has been observed in Canada. Airplane travel, by contrast, has increased its share of passenger travel everywhere — most markedly in the United States. The increased importance of airplane travel would be even more apparent for a number of other countries if international travel were included in the data.

Chart 2-5

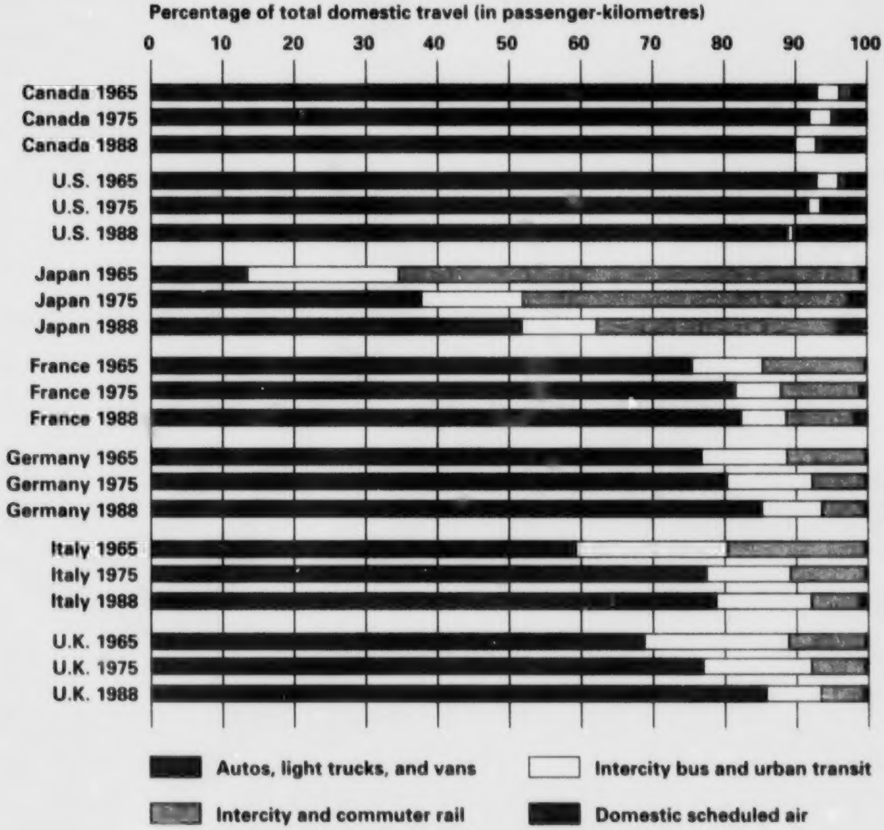
CHANGES IN MODAL SHARE OF DOMESTIC INTERCITY PASSENGER TRANSPORTATION, 1930–1990



Sources: Statistics Canada and Royal Commission staff calculations. For details, see Notes to Chapter 2 in Volume 2 of this report.

*Chart 2-6*

*INTERNATIONAL COMPARISONS OF MODAL SHARES IN TOTAL DOMESTIC TRAVEL, 1965, 1975 AND 1988*



**Sources:** Royal Commission staff calculations based on data from Statistics Canada, the European Conference of Ministers of Transport, and a number of U.S. and Japanese sources. For details consult the Notes to Chapter 2 in Volume 2 of this report.

**Note:** Total domestic travel includes both urban and intercity travel.

*Table 2-2*

### *MODAL SHARES OF TOTAL DOMESTIC PASSENGER TRAVEL, IN PASSENGER-KILOMETRES, SELECTED COUNTRIES, 1965–1988*

| | 1965 (%) | 1970 (%) | 1975 (%) | 1980 (%) | 1985 (%) | 1988 (%) |
|---|---|---|---|---|---|---|
| **Passenger-vehicle travel (e.g. cars, light trucks, and vans)** | | | | | | |
| Canada | 93 | 93 | 92 | 91 | 91 | 90 |
| United States | 93 | 92 | 92 | 90 | 89 | 88 |
| Japan | 14 | 35 | 38 | 42 | 46 | 52 |
| France | 75 | 82 | 81 | 82 | 82 | 82 |
| Germany | 77 | 80 | 80 | 81 | 83 | 85 |
| Italy | 59 | 76 | 77 | 76 | 77 | 79 |
| United Kingdom | 69 | 75 | 77 | 82 | 84 | 86 |
| **Intercity bus and urban transit** | | | | | | |
| Canada | 3 | 3 | 3 | 3 | 3 | 3 |
| United States | 3 | 2 | 2 | 2 | 2 | 1 |
| Japan | 21 | 17 | 14 | 14 | 12 | 10 |
| France | 10 | 7 | 6 | 7 | 6 | 6 |
| Germany | 12 | 11 | 12 | 11 | 9 | 8 |
| Italy | 21 | 12 | 12 | 14 | 14 | 13 |
| United Kingdom | 20 | 15 | 14 | 10 | 9 | 7 |
| **Intercity and commuter rail** | | | | | | |
| Canada | 2 | 1 | 1 | 1 | 1 | 1 |
| United States | 1 | 1 | ** | ** | ** | ** |
| Japan | 65 | 47 | 46 | 40 | 39 | 34 |
| France | 15 | 11 | 11 | 10 | 10 | 9 |
| Germany | 12 | 9 | 8 | 7 | 7 | 6 |
| Italy | 19 | 12 | 10 | 9 | 8 | 7 |
| United Kingdom | 10 | 9 | 8 | 7 | 6 | 6 |
| **Air (domestic scheduled services)** | | | | | | |
| Canada | 2 | 3 | 4 | 5 | 5 | 6 |
| United States | 3 | 5 | 6 | 8 | 9 | 10 |
| Japan | 1 | 1 | 3 | 4 | 4 | 4 |
| France | ** | 1 | 1 | 1 | 2 | 2 |
| Germany | ** | ** | ** | ** | ** | ** |
| Italy | ** | 1 | 1 | 1 | 1 | 1 |
| United Kingdom | 1 | 1 | 1 | 1 | 1 | 1 |

**Source:** Royal Commission staff calculations based on data from Statistics Canada the European Conference of Ministers of Transport, and a number of U.S. and Japanese sources. For details consult the Notes to Chapter 2 in Volume 2 of this report.

**Notes:** This table covers total domestic, not just domestic intercity, passenger transportion.

Data on total travel were used since internationally comparable data on the intercity portion of travel are not available. If intercity data were available, they would logically show an increased share for air, a decreased share for bus, and possibly a somewhat increased share for rail and somewhat decreased share for car.

Data may not be fully comparable across countries; thus the table should be used to make broad comparisons and significance should not be attached to small differences.

For geographically compact countries, domestic air travel may be unimportant. Data on total domestic and international air travel could be expected to show a much larger share for air for these countries.

** indicates share of less than 0.5%.

## CANADA'S PASSENGER TRANSPORTATION SYSTEM: 1992 AND BEYOND

How much and what kind of transportation will travellers want, and be willing to pay for, in the next 30 years? What kinds of transportation services will be available? There is always a great deal of uncertainty when looking into the future. Passenger transportation requirements are the result of many factors — for example, the country's economic performance and the income levels of Canadians, changes in work patterns and lifestyles, and the development of new technology.

Extrapolating on present directions in passenger transportation provides some indication of future directions. Based on current trends:

- The car will remain the preferred mode of transportation and will dominate the public modes.
- In recent years — the only years for which we have data — people aged 25 to 54 have tended to travel more than those in younger and older age groups. As Baby Boomers have moved into adulthood and middle age, travel has increased. Over the next decade, changes in the age structure of the population will have relatively little impact on the total amount of travel. But after the turn of the century, the movement of the Baby Boomers into older age

groups will, if current travel patterns persist, tend to slow the growth of travel.

- Most long-distance travel, including almost all travel in the North, will continue to be by air.
- As a result of its small population and market, Canada will mainly rely upon transportation technology developed elsewhere. Canadian governments can set Canadian requirements for airplane emissions, but if companies based in other countries do not build equipment to those specifications, Canada will be limited in what it can do to influence the introduction of new technologies.
- Canada shares an international border with the United States, a country whose economy is ten times as large. Canada will have to continue taking account of its physical link to the United States in making future passenger transportation decisions.
- Canada's climate will continue to affect the costs of transportation. A cold climate makes transportation more expensive for several reasons: it affects the design, construction and life-cycle of vehicles and infrastructure; the costs of operations; and the seasonal demands for some infrastructure and equipment.

Projecting current trends, however, may not paint a complete picture of future transportation requirements, for a number of reasons:

- The demand for travel in the future, within each age group, could be different from today's pattern. For example, advances in medicine, changing lifestyles, and rising per capita income could mean seniors of the future will travel more than seniors do today.
- An aging population, which would have more leisure time and a higher proportion of citizens with disabilities, could have different preferences in choosing modes of transportation.
- Canadians' concerns about congestion and pollution in major urban areas might weaken their preference for car travel. Even a small shift in private car use could have a dramatic impact on the public modes of passenger transportation.

- Globalization could lead to increasing international travel. There is already some indication that this might happen. For example, between 1980 and 1990, international trips increased at an average annual rate of 5.2 percent, while domestic trips rose by 1.9 percent.
- Improvements in telecommunications technology could reduce the demand for face-to-face meetings and, therefore, lessen the demand for travel (especially business travel). On the other hand, the possibility of worldwide mobile personal communication links may enable business people to "take their office with them," thereby increasing travel and mobility.
- New forms of travel, such as advanced supersonic aircraft, intelligent vehicle-highway systems, faster rail systems and high-speed ferries, could influence the way Canadians travel.

Based on the experience of the past 30 years, we doubt that there will be dramatic change in the way Canadians travel in the next 30 years. Markets will continue to change, but the providers of passenger transportation services are unlikely to face dramatic shifts in demand or radically new forms of travel in the near future.

Nevertheless, because predicting the future accurately is virtually impossible, we recognized early on that our proposed framework for the passenger transportation system had to provide enough flexibility for industry, governments and travellers to adjust to major changes, should they occur.

## CONCLUSION

Canada faces many opportunities and challenges, some of them similar to those of other countries. Canadians should understand how other countries are adjusting their passenger transportation systems. In other ways, Canada faces challenges and opportunities that are special — products of its unique history, geography, climate and culture. Canadians need solutions tailored to Canada's problems, issues and concerns.

# ENDNOTES

1. After the enactment of the *National Transportation Act of 1967*, the government made accompanying changes to the *Railway Act*, and Canadian railway companies enjoyed a more liberalized environment than their U.S. counterparts until U.S. substantial economic deregulation of rail in the early 1980s.

2. As indicated in endnote 2 of Chapter 1, the range is due to intercity car travel being defined as either car trips over 80 kilometres in one-way distance, or all highway use by cars. See Notes to Chapter 1 and Notes to Chapter 2, in Volume 2 of this report.

3. Source for data on total government employment in transportation and communications: Statistics Canada, *Public Sector Employment and Remuneration 1990/91*, Catalogue No. 72-209, October 1991. This source does not report data for transportation employment alone.

4. For a more detailed description of intercity passenger transportation, see Volume 2, Chapter 2, of this report and Chapter III of *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, 1991).

   Note: For both the domestic and international cases, intercity trips are defined as trips over 80 kilometres one way in this and the following section. This excludes many non-urban trips, especially by car, domestically, and many "cross-border shopping" international trips.

5. "Intercity" may be defined in different ways, and estimates of the amount of travel by car in particular are subject to considerable margins of uncertainty. Thus, our estimates of car travel, and of other means of transportation, in total intercity trips or in total passenger-kilometres travelled, should be viewed as approximate. See further discussion in Volume 2, Chapter 2 of this report.

# CHAPTER 3

# COSTS OF TRANSPORTATION AND WHO PAYS: TRAVELLERS OR TAXPAYERS?

## INTRODUCTION

An essential first step in examining transportation issues and in making sound decisions on passenger transportation is to understand the full costs of transportation today, including accident costs, the cost of damage to the environment, and the cost of providing infrastructure. Further, if travellers are to cover the costs of providing and maintaining the passenger transportation system — as we will recommend — it is important to know what proportion of total costs travellers currently pay and what proportion is borne by others.

Some Canadians may be concerned that transferring the costs borne by others to those who travel might increase costs of travel, discourage use of the passenger transportation system and slow economic growth. We remind them, however, that these costs are already being borne by Canadians. Funding transportation through charges, rather than taxes, would not, by itself, alter the total costs Canadians pay. Furthermore, we believe that the changes we recommend in how Canadians should pay for the passenger transportation system will also lead to changes that will lower the total costs of the passenger transportation system.

In our approach, travellers and carriers would pay full costs, but these costs would be based on principles of efficient investment and pricing. Travellers would not be paying for a passenger transportation system that is wasteful because it has too much or too little capacity, or capacity of the wrong type and in the wrong place. Travellers and carriers would be able to purchase services at the lowest possible prices for the greatest benefit.

The remainder of this chapter is devoted to estimating the comprehensive costs of the current system — a system that is not as efficient as it could become. Our figures, therefore, overestimate the total costs of transportation and the additional costs to be paid by travellers, but these figures are a key starting point in understanding the current system and the potential for change. In referring to costs paid by travellers, we include charges to carriers that will be passed on to travellers in the fares they pay.

## TODAY'S SUBSIDIES AND COSTS — HIDDEN AND DIRECT

Currently, taxpayers knowingly support the transportation system through direct subsidies and unknowingly through hidden subsidies. Direct subsidies are those that governments show in their budgets as amounts transferred to carriers or travellers from the taxpayers. Hidden subsidies are those that are less visible to the public.

Hidden subsidies hamper the development of rational transportation policy. During our public hearings, several interveners expressed frustration about hidden subsidies in the passenger transportation system. These subsidies may mislead governments trying to make decisions based on efficiency and competition, and certainly lessen the public's ability to assess policy decisions. If, for example, a government must choose between building a road for a certain route or providing rail service, it will be unable to make the wisest choice (the best transportation at the least cost to the traveller) if the true costs of road and rail are not known.

The House of Commons Standing Committee on Transport also recognized the problems associated with hidden subsidies. In its March 1992 report, *High Speed Rail: The Canadian Concept*, in Recommendation 9, the Committee stated ". . . considering it is essential to more accurately determine the amount of subsidy for each mode, the Royal Commission on National Passenger Transportation should place particular emphasis, in its Final Report, on the identification of the levels of hidden subsidization within each mode."

Hidden subsidies, direct subsidies, special advantages or disadvantages resulting from government action can arise in a number of ways.

*Transportation infrastructure costs:* Governments may provide infrastructure (terminals, links and traffic control — see Table 2-1 in Chapter 2) to a mode free of charge or for charges that do not recover the full costs. In these cases, the subsidy comes from the taxpayer and appears in government budgets. How the subsidy should be apportioned among different groups of travellers may be subject to debate.

*Environmental costs:* At present, governments allow transportation activities to cause damage to the environment without charging carriers or travellers for these damages. This is equivalent to a subsidy from today's public, who experience the adverse effects on the environment, and possibly a subsidy from future generations as well. Other than costs of some clean-up work performed by governments, which are included in their budgets, most of the costs associated with environmental damage (for example, discomfort or ill health) do not appear in government accounts.

*Accident costs:* Travellers do not pay all the costs associated with accidents. Some of the costs are paid for by public health insurance systems that do not recover, or only partially recover, the costs from transportation users and carriers.

*Special transportation taxes and fees:* These taxes and fees are specific to transportation, but are not designated as charges for infrastructure, environmental damage or accidents. They include fuel taxes, and vehicle, carrier and drivers' licences. In our view, general consumption taxes, such as provincial sales taxes and the Goods and Services Tax, do not constitute a special cost or disadvantage for a particular passenger transportation mode, since such taxes are applied broadly in the economy. These general taxes are not included in our analysis. But special taxes and fees on transportation fares, or on inputs such as fuel, are of interest because they may give one mode a financial advantage over another.

General property taxes applied on the same basis to all industries would not be included, but differentials in the application of property taxes — for example, levying such taxes on rail rights-of-way but not on road — should, in principle, be recognized. Where special taxes — or differentials due to above-average rates of general taxes — exist, they should be considered to offset hidden subsidies associated with infrastructure costs, environmental damage and accident costs currently paid by taxpayers.

We have estimated the costs related to transportation infrastructure, environmental damage, accidents, the revenues from special taxes and fees, and payments of direct subsidies. We use these estimates to consider how governments treat different types of passenger transportation.

## SYSTEM-WIDE COSTS

As we stated earlier, people will not be able to make sound transportation decisions unless they have comprehensive figures for the costs of travel in each mode. To our knowledge, such figures have never been calculated in Canada. We have estimated the system-wide costs of transportation and how much users currently pay, and how much others pay (Table 3-1 and Chart 3-1). The total costs borne by others provide an estimate of total subsidies, both hidden and direct.

"Users" are travellers, vehicle owners and carriers. "Others," who pay for costs of transportation although they may or may not be using the transportation system, are taxpayers (who cover the financial costs paid by governments) and the general public (who directly bear most environmental damage costs).

We caution, however, that our estimates of costs are imprecise because of the current lack of data. Nonetheless, we believe that our figures are useful to begin gauging the true costs of transportation in the different modes. It will be important for governments to develop better estimates before making future policy decisions, including setting charges for travellers.

We present these system-wide averages as an introduction. Later in the chapter, we provide estimates of the costs for particular routes, which may be more relevant to some policy decisions than the system-wide averages.

A simple basis for comparing costs between modes is the cost per passenger-kilometre, that is, how much it costs to carry one passenger one kilometre, or total costs divided by total passenger-kilometres. We recognize that cost per passenger-kilometre is not a perfect basis of comparison, because transportation by different modes is not always comparable. For example, when people travel by ferry and car, the costs are those of moving a passenger "accompanied by an average amount of car." On the other hand, the bus, airplane and train costs are only for passengers and their personal baggage. On some carriers, food is provided; on others, passengers pay extra for food. The average trip also differs across the modes. Air trips are generally much longer and ferry trips much shorter than those taken by road or rail. System-average costs per passenger-kilometre are therefore not fully comparable, but they do provide a start.

The costs of travel by different modes vary substantially. This is reasonable because some modes are more expensive to operate and provide more services than others. We are particularly interested, however, when costs not borne by users differ substantially by mode of travel. These variations indicate that government policy today is not neutral across modes and gives some modes competitive advantages over others.

## INTERPRETING TABLE 3-1 AND CHART 3-1

Table 3-1(a) illustrates the components of average costs, in cents per passenger-kilometre, for domestic travel by the different modes in 1991. Table 3-1(b) estimates the total costs of domestic intercity travel, in millions of dollars, for the different modes. Our total cost estimates for car travel in this chapter and in Chapter 18 refer to all car travel on highways, rather than the narrower definition of intercity car travel restricted to trips of 80 kilometres or more used in estimates in other chapters.

The components of system-average costs, Table 3-1(a), are also presented graphically in Chart 3-1.

The costs borne by users (including special transportation taxes and fees paid by travellers) are stacked so that the overall height of the bar on the left indicates the total costs borne by travellers.

The costs borne by others are stacked to form the bar on the right. The total length of the bar represents the gross cost borne by others, before subtracting revenue received from special transportation taxes and fees. The distance below zero at which the bar starts is equal to the amount received. (The segment below zero represents revenues from the same special taxes and fees that are shown as a cost to users by the segment at the top of the left bar.) Therefore, the total height of the bar above zero shows the net cost borne by others.

The height of the users bar may be compared with the height (above zero) of the others bar to see the relative net contributions of users and others to the means of transportation in question.

We use estimates for 1991 to provide a current view of costs. Where 1991 data on costs and system use are not available, our figures are based on older data projected forward to 1991. This increases the margin of error in the estimates. In addition, we have attempted to smooth out the impact of the recession; our estimates are for normal costs and revenues in 1991. The table shows system-average cost estimates per passenger-kilometre to the nearest tenth of a cent, and total cost estimates to the nearest million dollars. Later tables show route costs to the nearest dollar. This is done in order to show some small cost components that would disappear if the table showed numbers that were rounded to the extent appropriate for the larger cost components. All estimates, however, should be viewed as approximate.

The cost estimates are documented in Volume 2 of this report. In the following paragraphs, we briefly explain the meaning of each component of the costs.

*Table 3-1(a)*

**ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL, PAID BY USERS AND OTHERS, 1991, IN 1991 DOLLARS**

| Average costs: cents per passenger-kilometre | | | | | | |
|---|---|---|---|---|---|---|
| | **Car** | | | **Bus** | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 2.1 | 2.1 | 0.0 | 0.3 | 0.3 |
| **Environmental** | 0.0 | 0.6 | 0.6 | 0.0 | 0.2 | 0.2 |
| **Accident** | 3.7 | 0.1 | 3.8 | 0.4 | 0.0 | 0.4 |
| **Special trans. tax/fee** | 1.2 | −1.2 | 0.0 | 0.3 | −0.3 | 0.0 |
| **Vehicle/Carrier** | 10.9 | 0.0 | 10.9 | 8.4 | 0.2 | 8.6 |
| **Total** | **15.8** | **1.6** | **17.4** | **9.1** | **0.4** | **9.5** |
| | **Airplane** | | | **Train** | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 2.2 | 3.4 | 5.6 | 2.9 | 0.0 | 2.9 |
| **Environmental** | 0.0 | 1.0 | 1.0 | 0.0 | 0.6 | 0.6 |
| **Accident** | 0.1 | 0.0 | 0.1 | 0.2 | 0.0 | 0.2 |
| **Special trans. tax/fee** | 0.6 | −0.6 | 0.0 | 0.4 | −0.4 | 0.0 |
| **Vehicle/Carrier** | 14.4 | 0.1 | 14.4 | 7.4 | 32.8 | 40.2 |
| **Total** | **17.3** | **3.8** | **21.1** | **10.9** | **33.0** | **43.9** |
| | **Ferry** | | | **All intercity travel** | | |
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 4.7 | 4.7 | 0.2 | 2.2 | 2.4 |
| **Environmental** | 0.0 | 2.0 | 2.0 | 0.0 | 0.6 | 0.6 |
| **Accident** | 0.1 | 0.0 | 0.1 | 3.3 | 0.2 | 3.4 |
| **Special trans. tax/fee** | 0.9 | −0.9 | 0.0 | 1.1 | −1.1 | 0.0 |
| **Vehicle/Carrier** | 24.1 | 11.6 | 35.7 | 11.2 | 0.2 | 11.4 |
| **Total** | **25.1** | **17.4** | **42.5** | **15.8** | **2.0** | **17.8** |

*Table 3-1(b)*

### ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL, PAID BY USERS AND OTHERS, 1991, IN 1991 DOLLARS

Totals: $ millions

| | Car (210 billion pass-km) | | | Bus (3.3 billion pass-km) | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0 | 4,486 | 4,486 | 0 | 10 | 10 |
| **Environmental** | 0 | 1,211 | 1,211 | 0 | 8 | 8 |
| **Accident** | 7,874 | 172 | 8,046 | 13 | 0 | 13 |
| **Special trans. tax/fee** | 2,461 | −2,461 | 0 | 9 | −9 | 0 |
| **Vehicle/Carrier** | 22,817 | 0 | 22,817 | 277 | 8 | 285 |
| **Total** | **33,152** | **3,408** | **36,560** | **299** | **17** | **316** |

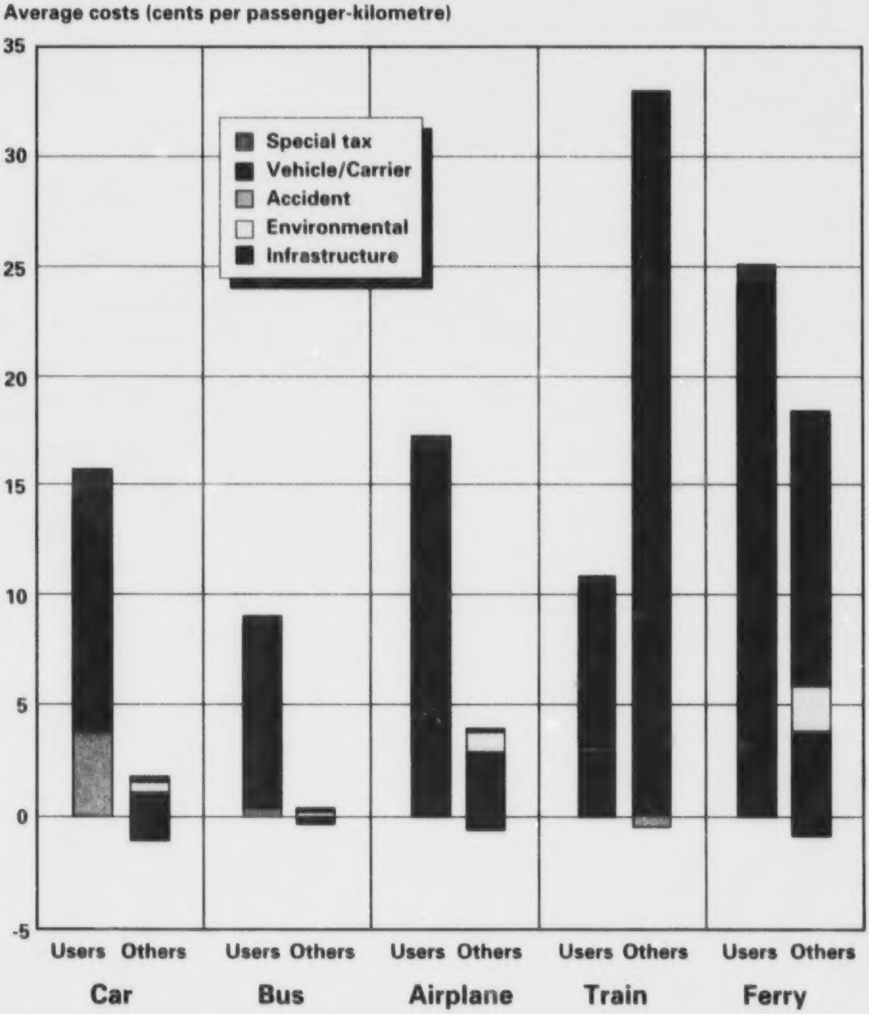
| | Airplane (25 billion pass-km) | | | Train (1.4 billion pass-km) | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 556 | 845 | 1,401 | 41 | 0 | 41 |
| **Environmental** | 0 | 247 | 247 | 0 | 9 | 9 |
| **Accident** | 25 | 0 | 25 | 3 | 0 | 3 |
| **Special trans. tax/fee** | 149 | −149 | 0 | 6 | −6 | 0 |
| **Vehicle/Carrier** | 3,595 | 0 | 3,595 | 104 | 459 | 563 |
| **Total** | **4,325** | **943** | **5,268** | **154** | **462** | **616** |

| | Ferry (0.85 billion pass-km) | | | All intercity travel (240 billion pass-km) | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0 | 40 | 40 | 597 | 5,381 | 5,978 |
| **Environmental** | 0 | 17 | 17 | 0 | 1,492 | 1,492 |
| **Accident** | 1 | 0 | 1 | 7,916 | 172 | 8,088 |
| **Special trans. tax/fee** | 7 | −7 | 0 | 2,632 | −2,632 | 0 |
| **Vehicle/Carrier** | 205 | 98 | 303 | 26,998 | 565 | 27,563 |
| **Total** | **213** | **148** | **361** | **38,143** | **4,978** | **43,121** |

Note: **In order to illustrate smaller components, averages are shown to the nearest tenth of a cent and totals to the nearest million dollars. In general, cost estimates are approximate and are not accurate to this level of precision. See text.**

*Chart 3-1*

*ILLUSTRATIVE COMPREHENSIVE SYSTEM-WIDE COSTS OF INTERCITY DOMESTIC TRAVEL, PAID BY USERS AND OTHERS, 1991*



Note: The chart is a graphic representation of Table 3-1(a). Any negative components of the costs borne by others are represented by shifting the others bar below the zero line.[1]

For purposes of our cost analysis, "infrastructure" consists of terminals, links and traffic control (including police systems) not provided by carriers. It excludes most bus terminals, some ferry docks, and some passenger rail stations that are provided by carriers. The total cost for transportation infrastructure is the sum of the estimated capital and operating expenses. (Where infrastructure is provided by a carrier, these costs are built into vehicle/carrier costs.) The others portion is the total cost minus the amount covered by charges paid by travellers and carriers.

The estimates of infrastructure costs include depreciation and interest on the investment in the facility. When the value of land is also a significant part of the total value of the facility, an interest charge on the value of land is also included in costs. The basis for the infrastructure cost estimates is discussed further in Chapter 5.

Infrastructure costs to travellers and carriers are charges levied by the infrastructure providers (primarily governments) to help cover the costs of building and operating them. For air travel, charges consist of the Air Transportation Tax, airport landing and terminal fees, and rent for airport space used by carriers. For rail travel, Canadian National Railways and Canadian Pacific Ltd. charge VIA Rail for use of track and other services (such as dispatch). For road travel, there are road tolls on one highway in British Columbia, but the revenues are so small relative to the total road system that they have not been included in the table.

Some infrastructure costs may be higher than necessary, in part because bigger or more elaborate facilities than travellers require have been provided. In this chapter, we set out existing costs; in subsequent chapters, we discuss whether and how some of these costs might be reduced.

Environmental costs result from the environmental damage caused by air and noise pollution from vehicle and carrier operations. As we pointed out earlier, the public generally bears these costs, which do not appear in government accounts. Environmental costs borne by others are the estimated values of the total damage and unpleasantness associated with vehicle emissions and noise (Chapter 7).

Accident costs include a valuation of death and injury, health care costs and property damage. Travellers pay accident costs through their insurance premiums and through injuries and damage not covered by personal insurance or government health insurance. Accident costs borne by others are government health care costs that are not recovered from self-financing vehicle insurance plans or from carriers (Chapter 8).

Special transportation taxes and fees include fuel taxes and vehicle, carrier and drivers' licence charges. These special transportation taxes and fees are different from other government charges to travellers, such as the Air Transportation Tax and tolls, since governments do not directly apply the revenues raised from the special taxes to cover the costs of transportation infrastructure, environmental damage or accidents. Therefore, our table shows special taxes and fees as a separate category of charge.

We believe special taxes and fees should be considered an offset to infrastructure, environmental costs and accident costs borne by the taxpayer or the public. We have, however, adjusted the fuel tax components of special taxes before including them in the table, since every province except Quebec exempts fuel from the general provincial sales tax. For these provinces, we consider only that part of the fuel tax in excess of the provincial sales tax rate to be a special tax on transportation.

In Table 3-1 and Chart 3-1, we show the special taxes and fees as a component, along with charges for infrastructure, environmental damage and accidents, of total costs paid by users. Since special tax revenues are not used to finance a particular type of transportation expenditure, they may be viewed as a general offset to costs borne by others. Hence, revenues from taxes and fees are shown in the others column with a negative sign. The resulting zero in the total column shows that these taxes do not increase the total costs of passenger transportation, but rather are a mechanism for determining who is paying what.

Vehicle/carrier costs are the capital and operating costs incurred by owners of private vehicles or by carriers providing public transportation. These costs also include infrastructure costs when carriers provide their own facilities, for example, when bus or ferry companies own their own terminals. Vehicle/carrier costs borne by users are calculated using fares charged to travellers or the costs of buying and operating a car, and subtracting charges to travellers and carriers for infrastructure, environmental costs, accident costs and special taxes and fees. In our estimates, vehicle/carrier costs also include costs arising from equipment requirements designed to lessen pollution or increase safety. (Such costs might alternatively be included under environmental or safety costs, but are difficult to separate from the basic cost of the vehicle.)

Vehicle/carrier costs borne by others represent direct subsidies to carrier operators. (In some cases, it might be argued that part of the direct subsidy should be viewed as covering infrastructure or other charges paid by the carrier, but we show the full direct subsidy as vehicle/carrier costs borne by others.)

Differences in the vehicle/carrier costs of each type of carrier, including cars, may not be considered relevant for government transportation policy decisions as long as travellers pay the costs and as long as monopoly pricing by carriers is not a concern. On the other hand, these vehicle/carrier costs form the largest component of total costs; it is useful to keep them in mind when considering whether costs currently borne by others are important or unimportant in the total picture for a given mode of travel.

In Table 3-1, total costs for users, others, and in total, are sums of their components. As mentioned earlier, we use total costs borne by others as our measure of the net subsidy from governments and the public to each means of transportation. The total of costs borne by users and others is, of course, our measure of the overall costs of providing each means of transportation. When we refer to "total costs," we are referring to this sum.

## CONCLUSIONS: TABLE 3-1 AND CHART 3-1

### Average Costs and Subsidies

Bus travel is the least costly mode. The average total cost of bus travel is 9.5¢ per passenger-kilometre. We estimate that bus travellers pay all but 0.4¢ per passenger-kilometre of this. Bus travellers receive the least subsidy per passenger-kilometre of all travellers.

Car and airplane travellers receive a somewhat larger total subsidy than bus travellers per passenger-kilometre. The general taxpayer and the public subsidize car travel by an estimated 1.6¢ per passenger-kilometre and air travel by 3.8¢ per passenger-kilometre. These subsidies cover infrastructure, environmental and accident costs not paid by users, plus small direct subsidies paid for air travel in some provinces, less special taxes collected.

The largest gaps between users and total costs are for train and ferry travel — 33¢ per passenger-kilometre for train and 17.4¢ per passenger-kilometre for ferry. This is due to large, direct subsidies from taxpayers to travellers using passenger rail and some ferry services (these direct subsidies are shown as vehicle/carrier costs borne by others).

### Environmental Costs

Our figures for environmental costs are based on high estimates for damage associated with carbon dioxide and other pollutants that affect air quality relative to the ranges of estimates available. We did this so the overall subsidy comparison would err on the side of favouring the less-polluting modes of passenger transportation. Although important, environmental costs do not turn out to be large relative to total costs for any of the modes. Environmental costs for bus travel are the lowest.

Some observers believe that car travel causes a great deal more pollution than train or bus travel. When car pollution is viewed in terms of the average per passenger-kilometre, however, its costs are not always the highest. There are several reasons for this. Regulations regarding car exhaust emissions have encouraged greater reductions in the amount of pollutants emitted by cars than by buses or trains. In addition, when train equipment is old, the occupancy rate is low, or dining and sleeping services as well as basic seating are provided, trains may use as much or more fuel per passenger-kilometre as cars.

Nevertheless, cars account for most pollution, because most travel is by car.

### Accident Costs

Accident costs per passenger-kilometre are much higher for travel by car than they are for any other mode. These costs account for almost one quarter of the total costs of car travel. Travellers bear most of these costs through insurance premiums and by paying for uninsured losses they suffer. Accident costs borne by others through unrecovered health care system costs are estimated to amount to 0.1¢ per passenger-kilometre. Costs of accidents borne by others for bus, air and train travel are negligible.

### Total Costs

Table 3-1(b) provides estimates of the total costs, in millions of dollars for each mode of transportation. In the preceding discussion, we have focussed attention on differences in average costs, especially those borne by others. The average costs borne by others largely represent subsidies from governments to the various modes less special taxes and fees collected by governments. As Table 3-1 shows, governments currently treat the various modes of travel differently.

Total cost estimates are also of interest, however, as they indicate the overall amounts spent on each mode of transportation. While the average subsidy rates for car and air travel are relatively low, the large numbers of kilometres represented by car and air travel mean the total subsidies to these modes account for the bulk of the estimated $5.0 billion total subsidy to domestic intercity passenger travel (estimated at $3.4 billion for car and $0.9 billion for airplane).

## COSTS: SOME SAMPLE ROUTES

In addition to estimating comprehensive, system-wide costs, we have estimated the costs per one-way trip for four intercity routes that represent different combinations of length and passenger volume:

- Toronto to Montreal — a high-volume, medium-distance route (Table 3-2 and Chart 3-2);
- Saskatoon to Halifax — a long-distance route consisting mainly of medium-volume segments (Table 3-3 and Chart 3-3);
- Val d'Or to Montreal — a medium-distance route including low-volume segments (Table 3-4 and Chart 3-4); and
- Vancouver to Toronto — a long-distance route with high-volume air travel (Table 3-5 and Chart 3-5).

(Costs for a route that includes a ferry segment are shown in Chapter 18.)

### INTERPRETING TABLES 3-2 TO 3-5 AND CHARTS 3-2 TO 3-5

In these tables, our estimates for total and users' vehicle/carrier costs are based on averages of costs and revenue yields for routes of similar volume and distance. They do not reflect actual carrier costs or revenues on the particular routes.

*Table 3-2*

## ILLUSTRATIVE COMPREHENSIVE COSTS OF INTERCITY TRAVEL, PER PASSENGER PER ONE-WAY TRIP, 1991, IN 1991 DOLLARS — TORONTO TO MONTREAL

|  | **Car costs currently borne by:** |  |  | **Bus costs currently borne by:** |  |  |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** ($) | 0 | 6 | 6 | 0.0 | 0.3 | 0.3 |
| **Environmental** ($) | 0 | 4 | 4 | 0.0 | 1.0 | 1.0 |
| **Accident** ($) | 20 | 0 | 20 | 2.2 | 0.0 | 2.2 |
| **Special trans. tax/fee** ($) | 6 | –6 | 0 | 0.8 | –0.8 | 0.0 |
| **Vehicle/Carrier** ($) | 59 | 0 | 59 | 36.6 | –3.0 | 33.6 |
| **Total** ($) | **85** | **4** | **89** | **39.6** | **–2.5** | **37.1** |
| **Distance travelled** (km) | 539 |  |  | 539 |  |  |
| **Costs per passenger-km** (¢) | 15.8 | 0.8 | 16.6 | 7.3 | –0.4 | 6.9 |
| **Costs per standardized passenger-km**[a] (¢) | 17.2 | 0.8 | 18.0 | 8.0 | –0.5 | 7.5 |

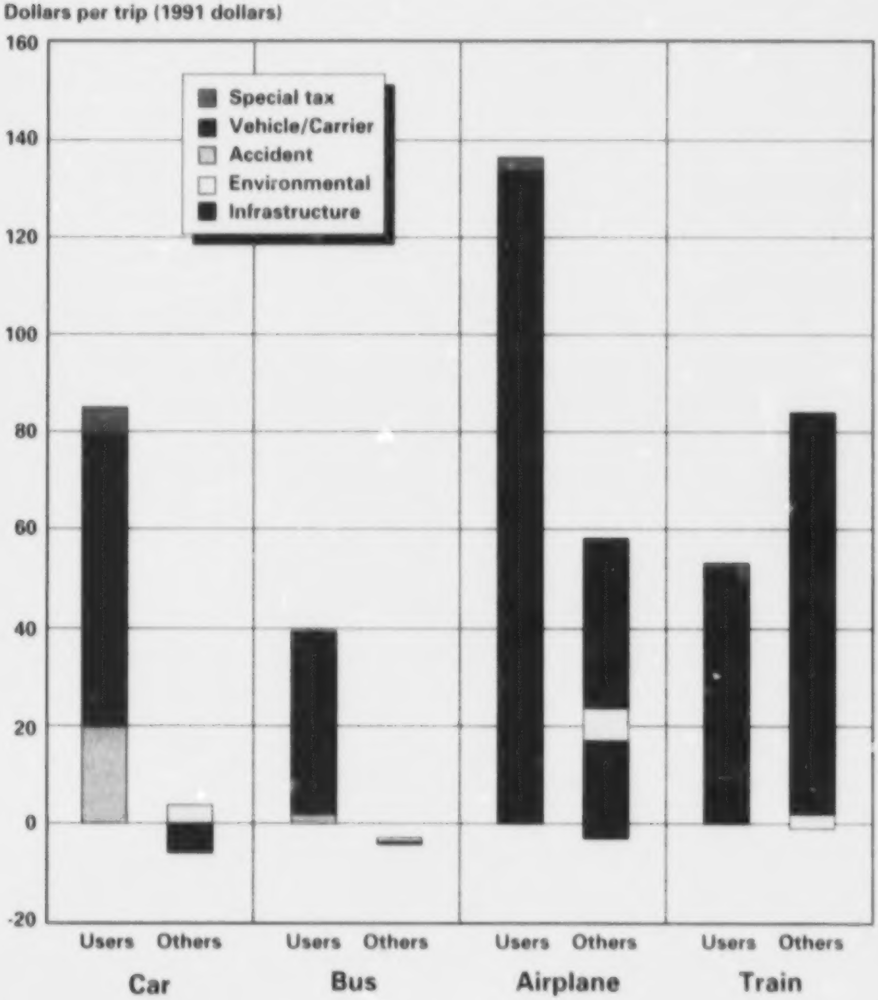
|  | **Airplane costs currently borne by:** |  |  | **Train costs currently borne by:** |  |  |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** ($) | 22 | 20 | 42 | 9 | 0 | 9 |
| **Environmental** ($) | 0 | 6 | 6 | 0 | 3 | 3 |
| **Accident** ($) | 0 | 0 | 0 | 1 | 0 | 1 |
| **Special trans. tax/fee** ($) | 3 | –3 | 0 | 1 | –1 | 0 |
| **Vehicle/Carrier** ($) | 111 | 35 | 146 | 42 | 82 | 124 |
| **Total** ($) | **136** | **58** | **194** | **53** | **84** | **137** |
| **Distance travelled** (km) | 496 |  |  | 540 |  |  |
| **Costs per passenger-km** (¢) | 27.4 | 11.6 | 39.0 | 9.8 | 15.6 | 25.4 |
| **Costs per standardized passenger-km**[a] (¢) | 27.4 | 11.6 | 39.0 | 10.6 | 17.0 | 27.6 |

a. **Standardized to air distance.**

Note: **In order to illustrate smaller components, averages per passenger-kilometre are shown to the nearest tenth of a cent and route totals to the nearest dollar. See text for qualifications.**

Chart 3-2

ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, DOLLARS PER TRIP, TORONTO TO MONTREAL



Note: The chart is a graphic representation of Table 3-2. Any negative components of the costs borne by others are represented by shifting the others bar below the zero line.[1]

Table 3-3

### ILLUSTRATIVE COMPREHENSIVE COSTS OF INTERCITY TRAVEL, PER PASSENGER PER ONE-WAY TRIP, 1991, IN 1991 DOLLARS — SASKATOON TO HALIFAX

| | | Car costs currently borne by: | | | Bus costs currently borne by: | |
|---|---|---|---|---|---|---|
| **Type of cost** | Users | Others | Total | Users | Others | Total |
| **Infrastructure** ($) | 0 | 67 | 67 | 0 | 8 | 8 |
| **Environmental** ($) | 0 | 21 | 21 | 0 | 7 | 7 |
| **Accident** ($) | 168 | 4 | 172 | 18 | 0 | 18 |
| **Special trans. tax/fee** ($) | 53 | −53 | 0 | 9 | −9 | 0 |
| **Vehicle/Carrier** ($) | 487 | 0 | 487 | 261 | 19 | 280 |
| **Total** ($) | **708** | **39** | **747** | **288** | **25** | **313** |
| **Distance travelled** (km) | 4,485 | | | 4,485 | | |
| **Costs per passenger-km** (¢) | 15.8 | 0.9 | 16.7 | 6.4 | 0.5 | 6.9 |
| **Costs per standardized passenger-km**[a] (¢) | 20.2 | 1.1 | 21.3 | 8.2 | 0.7 | 8.9 |

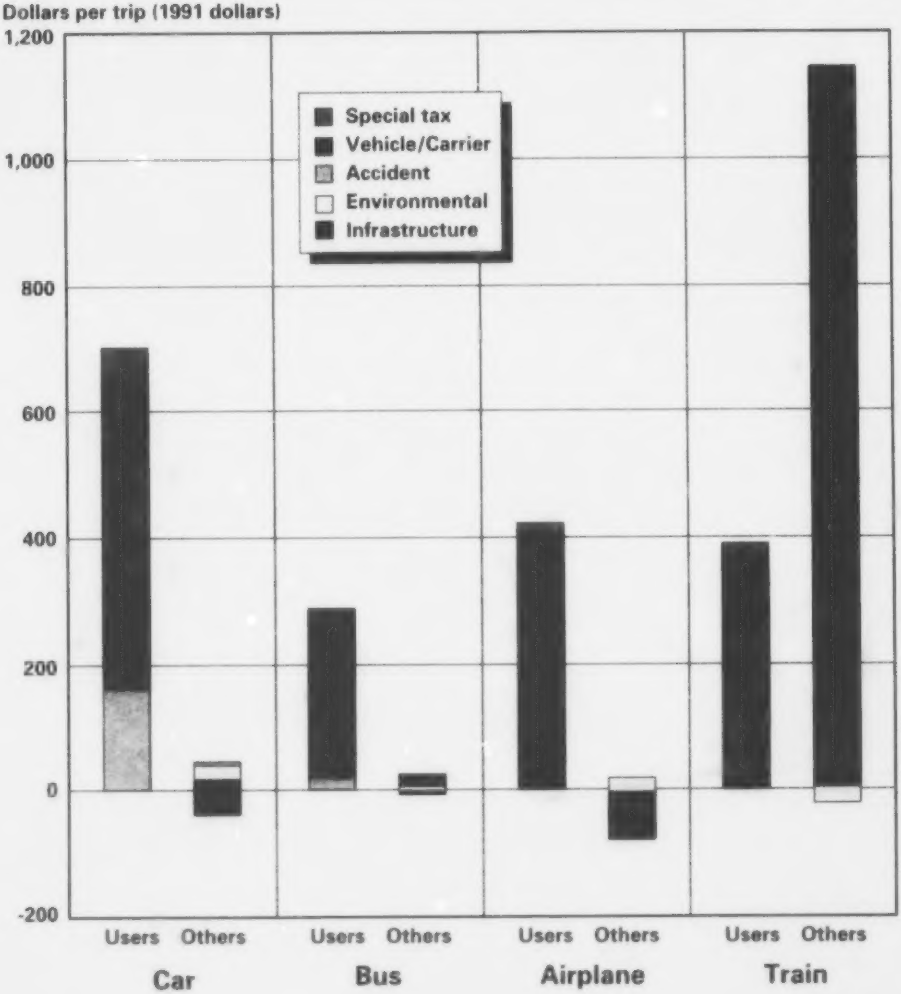
| | | Airplane costs currently borne by: | | | Train costs currently borne by: | |
|---|---|---|---|---|---|---|
| **Type of cost** | Users | Others | Total | Users | Others | Total |
| **Infrastructure** ($) | 37 | 68 | 105 | 93 | 0 | 93 |
| **Environmental** ($) | 0 | 22 | 22 | 0 | 28 | 28 |
| **Accident** ($) | 4 | 0 | 4 | 8 | 0 | 8 |
| **Special trans. tax/fee** ($) | 15 | −15 | 0 | 21 | −21 | 0 |
| **Vehicle/Carrier** ($) | 368 | −56 | 312 | 264 | 1,139 | 1,403 |
| **Total** ($) | **424** | **19** | **443** | **386** | **1,146** | **1,532** |
| **Distance travelled** (km) | 3,500 | | | 4,468 | | |
| **Costs per passenger-km** (¢) | 12.1 | 0.5 | 12.6 | 8.6 | 25.7 | 34.3 |
| **Costs per standardized passenger-km**[a] (¢) | 12.1 | 0.5 | 12.6 | 11.0 | 32.8 | 43.8 |

a. Standardized to air distance.

Note: In order to illustrate smaller components, averages per passenger-kilometre are shown to the nearest tenth of a cent and route totals to the nearest dollar. See text for qualifications.

Chart 3-3

### ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, DOLLARS PER TRIP, SASKATOON TO HALIFAX



Note: The chart is a graphic representation of Table 3-3. Any negative components of the costs borne by others are represented by shifting the others bar below the zero line.[1]

*Table 3-4*

## ILLUSTRATIVE COMPREHENSIVE COSTS OF INTERCITY TRAVEL, PER PASSENGER PER ONE-WAY TRIP, 1991, IN 1991 DOLLARS — VAL D'OR TO MONTREAL

| | Car costs currently borne by: | | | Bus costs currently borne by: | | |
|---|---|---|---|---|---|---|
| **Type of cost** | Users | Others | Total | Users | Others | Total |
| **Infrastructure** ($) | 0 | 9 | 9 | 0 | 1 | 1 |
| **Environmental** ($) | 0 | 2 | 2 | 0 | 1 | 1 |
| **Accident** ($) | 17 | 0 | 17 | 2 | 0 | 2 |
| **Special trans. tax/fee** ($) | 5 | −5 | 0 | 1 | −1 | 0 |
| **Vehicle/Carrier** ($) | 49 | 0 | 49 | 53 | 0 | 53 |
| **Total** ($) | **71** | **6** | **77** | **56** | **1** | **57** |
| **Distance travelled** (km) | 450 | | | 450 | | |
| **Costs per passenger-km** (¢) | 15.8 | 1.4 | 17.2 | 12.4 | 0.2 | 12.6 |
| **Costs per standardized passenger-km**[a] (¢) | 16.7 | 1.5 | 18.2 | 13.2 | 0.3 | 13.5 |

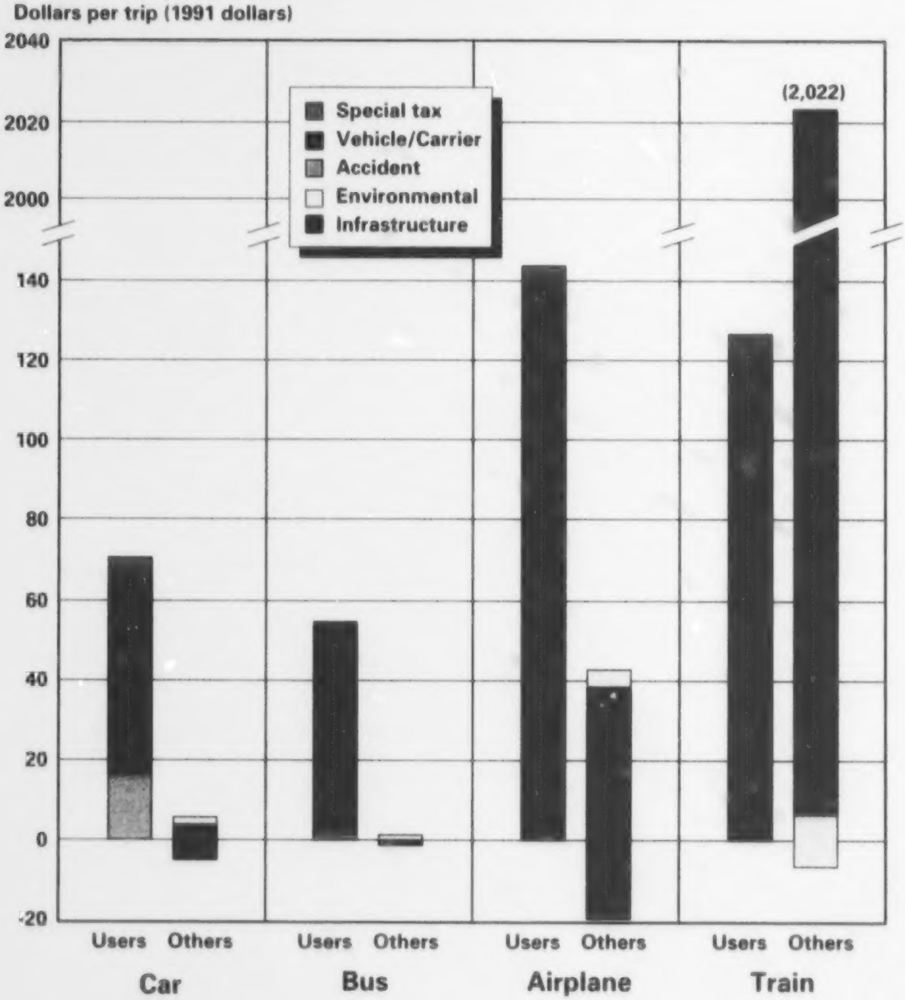
| | Airplane costs currently borne by: | | | Train costs currently borne by: | | |
|---|---|---|---|---|---|---|
| **Type of cost** | Users | Others | Total | Users | Others | Total |
| **Infrastructure** ($) | 23 | 57 | 80 | 53 | 0 | 53 |
| **Environmental** ($) | 0 | 5 | 5 | 0 | 13 | 13 |
| **Accident** ($) | 0 | 0 | 0 | 1 | 0 | 1 |
| **Special trans. tax/fee** ($) | 4 | −4 | 0 | 7 | −7 | 0 |
| **Vehicle/Carrier** ($) | 116 | −15 | 101 | 66 | 2,016 | 2,082 |
| **Total** ($) | **143** | **43** | **186** | **127** | **2,022** | **2,149** |
| **Distance travelled** (km) | 425 | | | 700 | | |
| **Costs per passenger-km** (¢) | 33.8 | 10.1 | 43.9 | 18.2 | 288.8 | 307.0 |
| **Costs per standardized passenger-km**[a] (¢) | 33.8 | 10.1 | 43.9 | 30.0 | 475.7 | 505.7 |

a. Standardized to air distance.

Note: In order to illustrate smaller components, averages per passenger-kilometre are shown to the nearest tenth of a cent and route totals to the nearest dollar. See text for qualifications.

Chart 3-4

## ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, DOLLARS PER TRIP, VAL D'OR TO MONTREAL



Note: The chart is a graphic representation of Table 3-4. Any negative components of the costs borne by others are represented by shifting the others bar below the zero line.[1]

*Table 3-5*

## ILLUSTRATIVE COMPREHENSIVE COSTS OF INTERCITY TRAVEL, PER PASSENGER PER ONE-WAY TRIP, 1991, IN 1991 DOLLARS — VANCOUVER TO TORONTO

| | **Car costs currently borne by:** | | | **Bus costs currently borne by:** | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** ($) | 0 | 66 | 66 | 0 | 8 | 8 |
| **Environmental** ($) | 0 | 20 | 20 | 0 | 6 | 6 |
| **Accident** ($) | 168 | 4 | 172 | 18 | 0 | 18 |
| **Special trans. tax/fee** ($) | 53 | -53 | 0 | 8 | -8 | 0 |
| **Vehicle/Carrier** ($) | 488 | 0 | 488 | 198 | 76 | 274 |
| **Total** ($) | **709** | **37** | **746** | **224** | **82** | **306** |
| **Distance travelled** (km) | 4,492 | | | 4,492 | | |
| **Costs per passenger-km** (¢) | 15.8 | 0.8 | 16.6 | 5.0 | 1.8 | 6.8 |
| **Costs per standardized passenger-km**[a] (¢) | 21.1 | 1.1 | 22.2 | 6.7 | 2.4 | 9.1 |

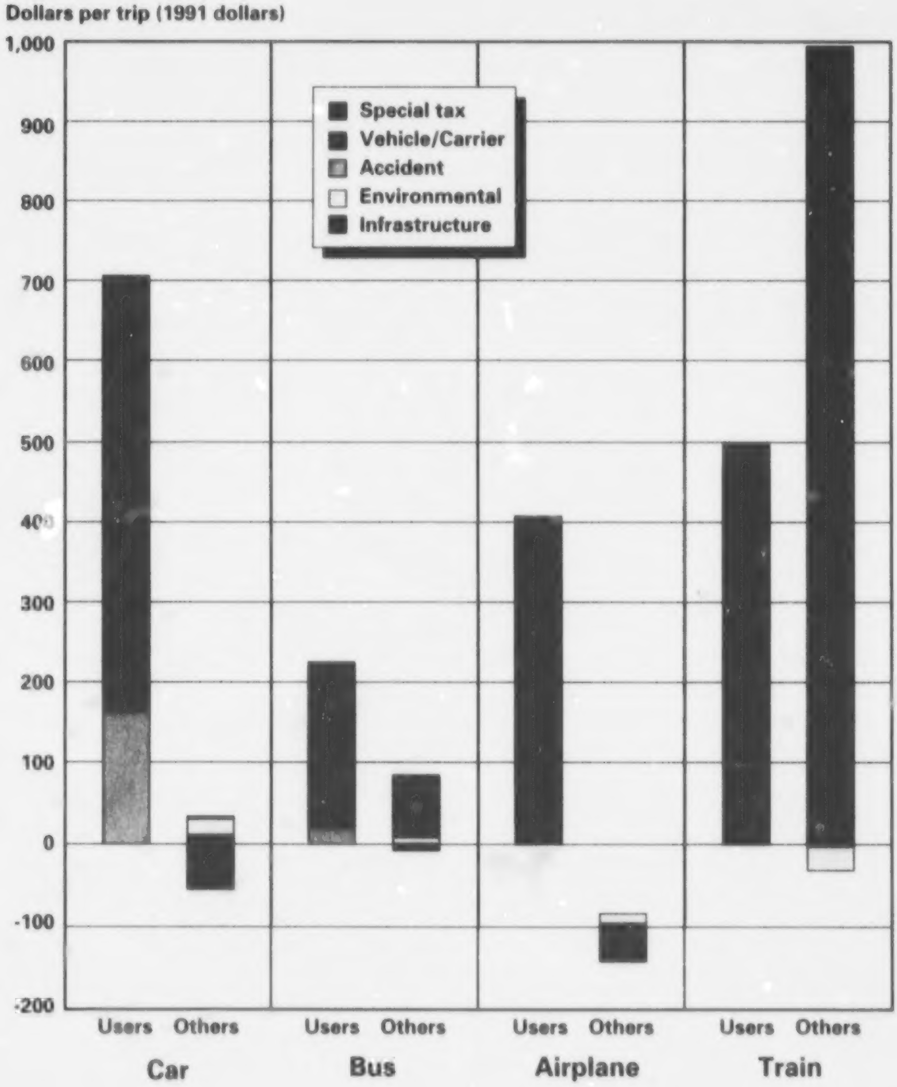
| | **Airplane costs currently borne by:** | | | **Train costs currently borne by:** | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** ($) | 28 | 44 | 72 | 91 | 0 | 91 |
| **Environmental** ($) | 0 | 13 | 13 | 0 | 26 | 26 |
| **Accident** ($) | 3 | 0 | 3 | 8 | 0 | 8 |
| **Special trans. tax/fee** ($) | 19 | -19 | 0 | 33 | -33 | 0 |
| **Vehicle/Carrier** ($) | 357 | -123 | 234 | 368 | 1,000 | 1,368 |
| **Total** ($) | **407** | **-85** | **322** | **500** | **993** | **1,493** |
| **Distance travelled** (km) | 3,365 | | | 4,467 | | |
| **Costs per passenger-km** (¢) | 12.1 | -2.5 | 9.6 | 11.2 | 22.2 | 33.4 |
| **Costs per standardized passenger-km**[a] (¢) | 12.1 | -2.5 | 9.6 | 14.9 | 29.5 | 44.4 |

a. Standardized to air distance.

Note: In order to illustrate smaller components, averages per passenger-kilometre are shown to the nearest tenth of a cent and route totals to the nearest dollar. See text for qualifications.

*Chart 3-5*

*ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, DOLLARS PER TRIP, VANCOUVER TO TORONTO*



Note: The chart is a graphic representation of Table 3-5. Any negative components of the costs borne by others are represented by shifting the others bar below the zero line.[1]

In addition to showing estimates for the components of the costs for each means of transportation on the route in question, the tables show the overall average cost per passenger-kilometre, borne by users, others, and in total. These average per-passenger-kilometre costs, calculated using the route lengths for each different means of transportation, provide a basis for comparing their operating characteristics. Because the route length between two centres can differ for different means of travel, for some purposes — for example when considering the overall amount of subsidy for travel between two points — it is of interest to compare per-passenger-kilometre costs on a standardized basis. We have used the air distance for this standardized comparison.

### Cross Subsidies

The difference between user and total vehicle/carrier costs on a route includes the impact of cross subsidies. Cross subsidies occur when a carrier uses revenues from profitable routes to cover part of the costs of unprofitable routes. For example, under provincial regulation, bus companies must provide service on low-volume routes in order to be granted high-volume routes; they subsidize the former with the profits from the latter. In our route tables, cross subsidies (the difference between estimates of total vehicle/carrier cost for the route and the vehicle/carrier share of fare revenues) are included in vehicle/carrier costs borne by others since other travellers on other routes pay these cross subsidies.

Some governments provide direct subsidies to buses on a small portion of total bus routes; these subsidies averaged across all bus travel are shown as vehicle/carrier costs borne by others in the system-wide costs. Cross subsidies do not appear in the system-wide average table (they cancel out). But, in the route tables, the amount in the others column for vehicle/carrier costs represents any direct subsidy plus any cross subsidy.

For bus routes of the Toronto to Montreal type, this amount is estimated to be negative. This is because although we estimate that the traveller pays an average of $36.60 toward vehicle/carrier costs for this type of trip, the average cost to the bus company is $33.60. In this case, there is no direct government subsidy and, therefore, the minus $3.00 shown for vehicle/carrier costs borne by others is a potential cross subsidy from passengers on this type of route to those travelling other routes operated by the same company.

On the other hand, for the Vancouver to Toronto type of route, we estimate that, given the lower bus fares for through-travel, bus passengers pay less than the average costs (average costs include a share in company overhead). In other words, they receive a cross subsidy. For air routes of the Vancouver to Toronto type, the vehicle/carrier situation is the reverse; on these air routes, passengers are estimated to contribute more than the average amount to profits. In other words they pay a cross subsidy.

In the case of trains, the entire amount of vehicle/carrier costs borne by others is an estimate of the direct taxpayer subsidy attributable to that route.

## CONCLUSIONS: TABLES 3-2 TO 3-5 AND CHARTS 3-2 TO 3-5

### Transportation Infrastructure Costs

On the high-volume Toronto to Montreal route, special taxes and fees for car and bus travel equal or exceed the costs of the road used. These special taxes and fees, however, do not fully offset the total costs of infrastructure, environmental damage and accidents. For air travel, infrastructure charges do not come close to covering costs for any of the domestic routes considered. On the medium-volume and lower-volume routes, as well as for the system-wide averages, special taxes and fees for car travel do not fully cover our estimate of the total capital, maintenance and other costs (including traffic policing) of roads.

### Environmental Costs

Estimates for environmental costs of train and airplane emissions per passenger-kilometre differ by route, reflecting different vehicle occupancy rates and the use of different equipment. As well, our estimates assign a higher cost to some pollutants if they are released during the summer in areas that already have problems with air quality (such as the Windsor to Quebec City corridor and the Lower Fraser Valley regions).

In terms of environmental costs, the train on the high-volume Toronto to Montreal route incurs costs that are somewhat lower than the car's and considerably lower than the airplane's, although higher than the environmental costs of bus travel. On this route, train equipment is newer and more fuel efficient, the number of seats per train is higher, and train occupancy rates are high. (In Chapter 7, we consider how the train's effect on the environment might improve with different equipment.) On the lower-volume rail routes, the train has considerably higher environmental costs than those of car, airplane or bus travel.

The environmental costs of airplane travel can be lower than those of car travel on direct longer-distance routes, as shown by the Vancouver to Toronto example. In aircraft operation, much of the noise, fuel consumption and emission of carbon dioxide and other pollutants occurs while waiting for or during take-off. For longer direct flights, therefore, environmental costs are proportionately lower than for short flights.

### Total Subsidies

On all the routes considered, bus travellers come closest to paying total costs if the cross subsidies among bus passengers are set aside. The total subsidy is larger for car travellers, but still not a large portion of total costs.

Total subsidies for air travel (excluding the impact of cross subsidies among routes) are larger than for car travel on most routes, and represent an appreciable share of total costs even on high-volume routes.

Subsidies to passenger rail include direct subsidies from taxpayers and some environmental costs. Transportation infrastructure costs are paid by the rail carrier for track use and train traffic control.

Even on the Toronto to Montreal route, which for the train has the lowest amount of direct (vehicle/carrier) subsidy from others and has the lowest environmental costs, the passenger rail subsidy is substantially larger than total subsidies to car or air travel. On the other routes, train costs borne by others (primarily the federal taxpayer) are many times larger than the subsidies to car or air travel.

## CONCLUSION

Only the bus comes close to paying its way in the passenger transportation system. Bus travellers pay almost as much in special taxes and fees charged by governments as the costs of government-provided infrastructure, environmental costs and accidents incurred by bus travel.

Both car and airplane travel have a competitive advantage over the bus, because car and air travellers pay less of the full cost of their transportation. Government charges for car and airplane travel do not fully cover infrastructure and environmental damage costs. (Environmental damage by car, airplane and bus has been limited by regulation, and car, airplane and bus travellers do pay the costs of equipment required to comply with the regulations.) Car travellers also do not fully pay for the costs that car accidents impose on the health care system.

Overall, subsidies from taxpayers for rail and ferry are the largest, on average, per passenger-kilometre.

The following chapters contain recommendations that will change many of the above costs and who pays them. In Chapter 18 we will look again at these estimates of comprehensive costs when we consider the overall impact of our recommendations.

# ENDNOTES

1. In the system-average table and chart, the only negative component of the others' costs is the special transportation tax/fee. This was represented in Chart 3-1 by a shift down in the others bar by the amount of special transportation tax/fee revenues. For the individual routes, cross subsidies are another potential negative component of others' costs.

   When users pay more than the vehicle/carrier costs associated with the route used, the excess is considered a contribution from users to others (other travellers). When this occurs, the base of the others bar is shifted below the zero line by an amount equal to the sum of revenues from special taxes and fees (a negative component of others costs) and of negative cross subsidies (cross subsidies available for other travellers).

   For example, for airplane travel on the Vancouver to Toronto route (Table 3-5 and Chart 3-5), the others bar starts at –142, the sum of –19 from special taxes and –123 from cross subsidy.

   Only the positive components of others' costs are shown as explicit segments of the bar. For Vancouver to Toronto airplane travel, the positive components add to 57, which is the vertical height of the bar above its –142 base.

   In a few cases for the individual routes, the negative components exceed the positive components of costs borne by others, resulting in negative net costs. In such cases, the top of the others bar, which indicates net costs borne by others, is below the zero line. For example, again for the Vancouver to Toronto airplane travel case, Table 3-5 shows net costs borne by others of –85. The top of the others bar for airplane travel in Chart 3-5 thus lies below the zero line at –85.

# CHAPTER 4

# NEW DIRECTIONS: FOUNDATIONS FOR A PASSENGER TRANSPORTATION FRAMEWORK

## INTRODUCTION

In Chapter 1, we discussed our approach to providing Canada with a new passenger transportation framework for the 21st century that would lead to more consistent, coherent and economically sound transportation decisions. In this chapter, we set out the foundation for this new framework, discuss its implications for governments, travellers and carriers, and suggest transition mechanisms to get from the current situation to our proposed framework.

## FOUNDATIONS FOR A NEW FRAMEWORK

We believe that the main goal of Canada's intercity passenger transportation system should be straightforward — to move people to where they want to go. Travellers should be able to choose the transportation services they want, get what they pay for, and pay for what they get.[1]

In the past, governments have used the transportation system to pursue other public policy goals. We believe that the passenger transportation system should not be used by governments in this way, today or in the future. As well, the traveller should not be asked to pay for the implementation of broad, national goals that are properly the responsibility of the general taxpayer.

In this report, we spend much time and space discussing charges to travellers. These include fares, fees, fuel taxes and licences. We realize that many of our recommendations may seem to advocate a greater financial burden on a public already unhappy about prices and taxes. Although this may be the appearance, it is neither the reality, nor does it represent the fundamentals of what our approach will achieve. Although Canadians may be unhappy with transportation-related prices and taxes, and be unwilling to see them increase, they are nevertheless already "paying" all of the costs of transportation in some way. For example:

- taxpayers pay a substantial portion of the cost of the infrastructure used by travellers and subsidize some carriers directly;
- people with asthma pay for low-level ozone concentrations in cities through discomfort and poor health;
- commuters pay for traffic congestion in lost hours;
- homeowners pay for car, truck and airplane noise when they cannot enjoy their homes and yards; and
- everyone pays for the general degradation of the environment.

What we advocate in this report is that those who supply and those who use passenger transportation services pay the costs of their activities. Those who do not use passenger transportation services should not have to pay for them. In addition, those who pay in non-monetary ways should gain relief or compensation. This, we believe, would be a much more equitable system than the one we have today. Our recommendations should also result in a more efficient passenger transportation system and a lower financial burden on Canadians, and would enable governments to reduce taxes with the money saved.

## OBJECTIVES

We believe that Canadian passenger transportation policy will be in the forefront worldwide if it leads to a passenger transportation system that is safe, protective of the environment, fair and equitable to taxpayers and all groups of travellers, and efficient.

Therefore, we **recommend** that:

**4.1 Transportation policies be guided by the following four objectives:**

**(a) safety;**

**(b) protection of the environment;**

**(c) fairness to taxpayers, travellers and carriers; and**

**(d) efficiency, so that services are provided only where the benefits to the individual traveller equal or exceed the cost, and given levels of service are provided at the lowest possible cost.**

Efficiency may strike some as a rather abstract objective, of interest primarily to economists. But this is not the case; efficiency means making the best use of one's resources and opportunities or, more simply, avoiding waste. As householders know from managing their family's finances, avoiding waste will get the most out of the family's income, or — in economic terms — will maximize its benefits, given its resources.

There are three types of waste to avoid. The first type of waste occurs when people spend more than is necessary to obtain goods or services. The parallel situation in transportation policy is when more is spent than is necessary — using a more expensive capital facility than necessary, or employing more people than necessary — to produce transportation services.

The second type of waste occurs when the householder would be better off not buying (or buying less of) the particular goods or services, and instead using the money on something else. The parallel situation in transportation occurs when governments decide to spend money on a particular transportation service, even though an alternative transportation service would be more worthwhile, or when Canadians would be better off using the money to obtain other things.

Thirdly, not spending money can also, in some cases, be a source of waste. Not spending on maintaining a car or house may require a higher level of spending in the future. For example, not spending money on a new furnace may be more than offset by higher fuel bills over time and thus constitute waste. In transportation, failure to devote sufficient resources to maintaining a road may result in having to spend much more in the future, or in a major reduction in the usefulness of the road. Failing to provide an airport in a community that has grown substantially may lose an opportunity to save major amounts of time for people travelling to and from the community. If people value the time savings sufficiently, the lack of spending on the airport would constitute waste or inefficiency.

Choosing efficiency as one of the objectives to guide passenger transportation policy simply recognizes that passenger transportation systems that avoid waste will contribute the most to Canadians' economic well-being.

Protecting the environment and maintaining safety are part of Canadians' present and future well-being. The efficiency objective can, therefore, be broadly interpreted to include achieving adequate levels of safety and environmental protection. This was the approach we took in our Interim Report. For greater clarity, we identify environmental protection and safety as separate objectives.

What about other objectives? We agree with those Canadians who told us that nation-building and regional development should be objectives of the various levels of government. We also believe that these objectives can be pursued through a variety of policies.[2] We do not agree, however, that passenger transportation policies should be guided by objectives of nation-building and regional development. Our reasons are as follows:

*Nation-building:* In general, the passenger transportation system is mature, and most Canadians are well served by a number of modes. We do not believe that any single project, route, network or mode is likely to stand out today, as the transcontinental railway once did, as a symbol that unites Canada. We doubt that any new passenger transportation mega-project would contribute to building the nation, beyond its economic contribution, which can be assessed using normal criteria.

To be sure, there is a need to bind Canada together, but we believe that individual Canadians — aided by volunteer organizations and government departments other than transportation departments — can most effectively carry out the task of binding the nation together.

*Regional development:* We recognize that passenger transportation infrastructure and services can play a vital role in the development and functioning of national and regional economies. As we suggest in our efficiency objective, the benefits of infrastructure and services to travellers should be compared with costs when decisions on passenger transportation projects and services are made. From our research and consultations, we concluded that the separate and additional regional development benefits that may be derived from government expenditures on passenger transportation are unlikely to be substantial and should not be used to guide passenger transportation policies. Our reasoning is threefold.

First of all, passenger transportation projects and services that are likely to contribute to regional development will pass the benefit-cost test under the efficiency objective. The benefits that regions gain from passenger transportation projects, other than those associated with benefits to travellers, are generally limited. In almost all the populated parts of Canada, the basic passenger transportation infrastructure already exists. Adding more or improved infrastructure, if that does not increase traveller benefits more than costs, is a questionable means of stimulating development. Half-empty roads and underused airports would be the likely result.

Secondly, we recognize that regions may realize short-term economic gains from construction activities associated with passenger transportation projects, but these activities do not have the same economic effect today as they did in the past. Construction is increasingly automated, and equipment and materials are often purchased from other regions.

Furthermore, non-transportation projects also require construction. We do not believe that transportation projects should be singled out by governments for subsidies in order to carry out regional development objectives for which they are not designed.

Finally, under the terms of our mandate, we are to consider long-term passenger transportation policies for 30 or more years into the future. We have therefore focussed on the benefits that will continue many years after projects are completed. Projects not supported by a review of the needs of travellers, and the benefits to them, place a long-term drain on financial resources that could otherwise be positively used for the development of Canada or its regions.

Therefore, we **recommend** that:

**4.2 Governments pursue nation-building and regional development objectives through other programs, rather than using the passenger transportation system.**

If governments decide to pursue nation-building, regional development or any other objectives through the passenger transportation system, taxpayers in the jurisdiction that makes the decision should pay the cost of such programs, rather than those who use the passenger transportation system. As well, governments should let the public know why they are providing such subsidies and at what cost. We strongly believe that the use of subsidies should be the exception, not the rule.

## PRINCIPLES FOR TRAVELLERS

How can we translate our four objectives into operational principles? Our broad goal is to move people to where they want to go, using any means for which they are prepared to pay, but avoiding waste. That is, we want a passenger transportation system that is safe, protects the environment, is fair to taxpayers, travellers and carriers and is efficient.

In many circumstances, market forces are a reliable guide for achieving the best use of resources. Market prices provide important signals about the kinds of travel services that travellers want, and competition provides an important discipline on those who provide these services. To prosper in a competitive environment, firms must respond to travellers' preferences, cut costs, improve productivity and innovate — all of which contribute to increased efficiency. Relying on market forces will also contribute to fairness. Individual travellers will pay for the choices they make, and they will pay the full costs of their travel without help from the taxpayer or other travellers.

The principles flowing from our four objectives have four thrusts. First, for much of Canada's history, transportation has played a nation-building or developmental role and Canadians have come to regard it as a public service like national defence, rather than a business like a hotel or restaurant. Too often in transportation, there has been a failure to appreciate the benefits from competitive markets — and the costs of restricting competition. Therefore, one of the main thrusts of our principles is to achieve the benefits from treating transportation like any other business where people buy and sell services, instead of as a government function. We have to identify areas, both in the activities of carriers and the providers of infrastructure, where there would be benefits from a greater reliance on competitive markets.

Second, treating transportation as a business will not work in all circumstances. Therefore, a second thrust of our principles must be directed at those areas where the market does not work very well — where it would not provide adequate levels of safety or environmental protection or where it would not be efficient or fair to travellers or taxpayers.

If carriers and providers of infrastructure do not have to take account of the impact of their activities on the environment and the health care system, the prices they charge can result in Canadians travelling by polluting or dangerous means of travel because it is cheap. Governments can correct this by ensuring that environmental and health care costs are taken into account by carriers, infrastructure providers and travellers.

In some cases, particularly for airport and highway infrastructure, it may not be possible to have more than one provider. When services or infrastructure are provided under these monopoly conditions, providers might charge prices that are too high or might not provide the service that travellers want and are willing to pay for. Governments can take steps to ensure that the services provided and the prices charged to travellers are similar to what might be expected if competition did exist.

A third thrust of our principles is directed at those situations where leaving passenger transportation to operate in a business context would have unacceptable results and must, therefore, be modified to take account of an important public interest. Although "public interest" is a vague and potentially all-encompassing term, our focus is specific. We believe that government intervention is necessary in two circumstances:

- to take care of the special transportation needs of people with disabilities; and
- to help firms and travellers who would be especially disadvantaged by an abrupt introduction of market forces to adjust to a potentially dramatic change in their operating environment.

The fourth and final thrust of our principles must be to ensure that government fulfils its role in a responsible manner. An informed public is the best check on governments. We believe there is a need for political decisions on transportation to be transparent, so that taxpayers and travellers can make informed choices. Some specific changes could help:

- Decentralization may contribute by providing those affected by government decisions with an increased say in those decisions.
- Those making decisions could be more effectively held accountable if taxpayers and travellers better understood the implications of decisions.

Our principles must impose greater responsibility for achieving our objectives on all the participants in the intercity passenger transportation system — travellers, carriers, providers of infrastructure, governments and their agencies.

These objectives will be best achieved if the passenger transportation system is supported and maintained by those who use it. Travellers should pay for the travel services they use. People who do not travel should not have to pay for those who do.

Therefore, we **recommend** that:

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**4.3 Each traveller pay the full cost of his or her travel, and travellers, in total, pay the full cost of the passenger transportation system, including those costs related to protecting the environment, safety and accidents.**

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We recognize that some Canadians may not be able to pay for the transportation they require. In general, when people need financial assistance to travel, this help should be provided to them through general or specific assistance programs, not by charging other users of the passenger transportation system.

In some cases, such assistance may still not make transportation services available to all. For example, although some people with disabilities could receive financial assistance to pay for travel, they may still lack physical access to passenger transportation services and infrastructure. Carriers and providers of terminals have a responsibility to provide accessible passenger transportation and should have a caring attitude toward people with disabilities.

Therefore, we **recommend** that:

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**4.4 Travellers with physical or mental disabilities have opportunities similar to those enjoyed by all Canadians to use public passenger transportation.**

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## PRINCIPLES FOR CARRIERS

We believe that passenger transportation carriers should provide services in a competitive environment, operating under the same commercial principles, economic forces and general rules as most other businesses in the Canadian economy. They may, however, also be subject to government rules designed for transportation, such as those associated with safety or environmental protection. As long as these carriers are charged appropriately for safety, accident and environmental costs, competition in the marketplace should be relied upon to determine the most efficient pricing and investment decisions.

Therefore, we **recommend** that:

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**4.5 Competition and market forces be the prime agents in providing viable and efficient carrier services:**

**(a) anyone "fit, willing and able" to supply passenger carrier services have an opportunity to do so;**

**(b) carriers (including private car and private airplane owners) pay their share of the full cost of the terminals, links and traffic control services that they use, as well as any costs related to environmental damage, safety and accidents;**

**(c) as long as they are willing to pay their share of the costs, carriers have equal access to terminals, links and traffic control services; and**

**(d) anyone providing carrier services be able to withdraw these services, without undue delay, but with adequate notice to the public.**

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## PRINCIPLES FOR PROVIDERS OF TERMINALS, LINKS AND TRAFFIC CONTROL

Terminals such as airports, links such as roads or railway tracks, and related services such as traffic control are essential for getting travellers to where they want to go. Carriers and travellers told us that if they are going to be asked to pay the full cost for these terminals, links and traffic control services, they want to be sure that what is provided is only what is needed, no more, no less. We agree.

Therefore, we **recommend** that:

**4.6 Terminals, links and traffic control services be priced on a terminal-by-terminal, link-by-link and service-by-service basis.**

We recognize that prices could also be determined by averaging across a number of links or facilities, and that, in the short term, this type of pricing may be the most feasible approach in cases such as roads.

In some circumstances, prices can be determined through market forces, as happens when one airport faces competition from a nearby airport, or when a user of a facility is in a strong bargaining position with the provider of the facility, such as a dominant airline's relationship with some airports.

Therefore, we **recommend** that:

**4.7 Where there is sufficient competition, or where users are in a strong bargaining position with providers of terminals, links or traffic control services — and so long as there are appropriate charges for environmental damage, safety and accidents — competition and market forces be relied upon to determine prices and investment decisions for passenger transportation infrastructure.**

Where terminals, links and traffic control services are provided on a monopoly or near-monopoly basis, market forces cannot be relied upon to determine prices. Monopolists can charge prices above costs and normal profits, or inflate costs by over-building. Where competitive forces are not sufficient, or where users are in a weak bargaining position, governments, as referees, must regulate prices and investment decisions on an intermodal basis.

Therefore, we **recommend** that:

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**4.8 Where regulations are required, they be designed to ensure that pricing and investment decisions be similar to what would otherwise occur through competitive market forces. Specifically, we recommend that:**

**(a) prices reflect the traveller's or carrier's use of each terminal, link or traffic control service and be designed to encourage neither over-use nor under-use. Where such prices do not recover the full cost, we recommend that they be adjusted to provide for full cost-recovery in such a way as to minimize the loss of efficiency; and**

**(b) investments be made only in those projects where benefits to travellers exceed costs and that yield the highest level of benefits over costs, regardless of mode. In making investment decisions, all costs, including safety, accident and environmental costs, as well as interest on funds invested, should be taken into account; adequate provisions should be made for maintenance; new technologies should be considered along with existing technologies; and full consideration should be given to the potential for intermodal operations to contribute to efficiency and ease of travel.**

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# IMPLICATIONS FOR GOVERNMENTS

## FUNCTIONS OF GOVERNMENT

We have said that competition and market forces should be the prime agents in developing a viable and efficient passenger transportation system. There are some functions in the passenger transportation system, however, that can only, and should only, be performed by governments.

Governments should be responsible for:

- establishing policies in relation to the framework — setting policy with respect to transportation agencies, establishing guidelines for project evaluations, notably for the assignment of joint costs to modes and user classes, taking a cross-modal view of transportation issues and coordinating the development of environmental and safety policies with respect to transportation;
- standards setting and enforcement — imposing safety and environmental standards, and applying charges to reflect the costs of environmental damage;
- data gathering and reporting — setting reporting requirements, and presenting data in a way that allows ready comparison by users among the various modes of transportation;
- research — together with providers of services, governments finance and carry out selected research on passenger transportation (the results of much passenger transportation research cannot be patented or sold but are of public benefit);
- maintaining competition — ensuring that carriers do not engage in anti-competitive behaviour (for example, by guaranteeing equal rights of access by carriers to terminals, links or traffic control in cases where failure to provide access could restrict competition, especially where carriers own the terminals or links, such as railway tracks or bus terminals); and
- regulating monopolies — regulating pricing and investment decisions of terminals and links that are provided on a monopoly or near-monopoly basis.

Therefore, we **recommend** that:

**4.9 Governments be responsible for establishing policies in relation to the framework, setting and enforcing standards, gathering and reporting information to the public, ensuring a sufficient level of research, maintaining competition and regulating monopolies.**

## ASSIGNING RESPONSIBILITY TO LEVELS OF GOVERNMENT

We believe that assigning responsibility to the level of government closest to the people is consistent with our objectives, since our approach does not require that transportation responsibilities be assigned to particular levels of government — whether federal, provincial, territorial, regional or municipal.

In some cases, benefits or costs may extend beyond the boundaries of one jurisdiction. Only a higher level of government, or governments acting jointly, may be able to ensure consistency. At a minimum, cooperation among the different levels of government that have responsibilities for establishing the framework, making the rules, and refereeing would be required.

In other cases, the delegation of powers or jurisdictional modifications might be required. If formal constitutional change is needed to meet our objectives, then governments should consider implementing such change.

Therefore, we **recommend** that:

**4.10 Decision making authority of governments be assigned to the level of government that is both closest to the people and most able to efficiently exercise such authority.**

## EQUAL TREATMENT OF MODES

When governments collect taxes for general revenue purposes — a general sales tax as opposed to charges to travellers — they should tax all modes of transportation on the same basis.

When governments impose charges to pay for infrastructure and services that are government-owned, the charges should reflect the efficient cost of providing the infrastructure or a service, and the revenue from the charges should be used for that purpose.

Governments should levy charges to cover any other costs that transportation activities impose on society, whether the activities arise from operations of a publicly or privately owned carrier, facility or service. Where regulations are used in place of charges, they should impose similar obligations on each mode.

Therefore, we **recommend** that:

**4.11 Governments tax and regulate all modes equally.**

## ACCOUNTABILITY

Those responsible for making and applying the rules and for spending taxpayers' money should be accountable for their actions to these same taxpayers. Governments should improve such accountability through transparency — making relevant information available and understandable.

When governments consider providing taxpayer subsidies, such subsidies should be openly debated and visible. Full disclosure of the costs of the system — revenues, subsidies, who pays and who benefits — will help people to make their own transportation decisions and to judge those made by governments. Disclosure will also provide a mechanism that enables the public to hold government agencies accountable.

Therefore, we **recommend** that:

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**4.12 Decision making be transparent so that Canadians understand why governments or their agencies make the passenger transportation choices they make, and so that those making decisions can be held accountable.**

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## TRANSITION MECHANISMS

We recognize that today's passenger transportation system is a long way from embodying the objectives and principles outlined in this chapter, and that such a passenger transportation system could not be achieved at once.

Immediate action to implement the new objectives and principles could lead to sharp price increases that travellers would consider unreasonable, or could jeopardize the viability of a carrier or a particular carrier service, terminal or link. Time may be needed to allow prices to adjust, and to permit current service levels to be reduced, or otherwise modified, to match demand at an unsubsidized price. Governments will also need time to assess environmental and social costs. Any transition assistance should be subject to strict guidelines.

Therefore, we **recommend** that:

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**4.13 In cases where time is required to ease the problems caused by steep price adjustments, or where a carrier, a particular carrier service, a terminal or a link is given another chance to survive within the new framework, financial assistance be designed to encourage adjustment. Such assistance should be:**

**(a) given, where possible, to move people in the most efficient way, regardless of mode;**

**(b) provided and managed by the level of government responsible for the mode;**

**(c) borne by general taxpayers in the jurisdiction that makes the decision, not by other transportation users; and**

**(d) provided on a declining basis, for a predetermined, reasonable adjustment period, and then terminated.**

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**4.14 If a carrier, a particular carrier service, a terminal or a link cannot survive despite a reasonable period of time for adjustment, the terminal or link be closed or the service discontinued.**

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Carriers and providers of terminals, links and traffic control services should be given maximum flexibility from regulation in order to adjust fares and the frequency and quality of service. This flexibility should also permit substituting services that use another mode of transportation.

## CONCLUSION

Establishing the foundations for a new framework and the transition mechanisms required to achieve them are only first steps toward solving transportation problems. We must emphasize that these first steps are essential if Canadians are to make the right decisions in the future.

In the following chapters, we apply our approach to a range of issues in intercity passenger transportation.

# ENDNOTES

1. The test of "demand" should be the price that travellers are prepared to pay and the test of "supply" should be the amount that would be provided in a competitive market, when all costs are taken into account.

2. If, for example, governments decide that it is desirable to encourage students to travel around Canada by subsidizing 20 percent of their fare, this could be accommodated by the transportation system but we do not view it as a transportation policy. The cost should be ascertained and the full cost should be paid to the passenger transportation system by all taxpayers. The passenger transportation system and its travellers should not have to shoulder the burden for a nation-building policy that governments feel benefits all Canadians.

# CHAPTER 5

# TRANSPORTATION INFRASTRUCTURE: INVESTMENT AND PRICING

## INTRODUCTION

One of our objectives for the national passenger transportation system is fairness to users, carriers and the general taxpayer. We believe that fairness cannot be achieved if the current system of payment for government-provided transportation infrastructure remains in place. This system gives some modes a competitive advantage over others, and often means that the general taxpayer, who may not travel often or at all, pays for Canadians who do. As we stated in Chapter 4, our principles are that:

- each traveller pay the full cost of his or her travel, and travellers, in total, pay the full cost of the passenger transportation system, including those costs related to protecting the environment, safety and accidents (Recommendation 4.3);
- carriers (including private car and private airplane owners) pay their share of the full cost of the terminals, links and traffic control services that they use, as well as any costs related to environmental damage, safety and accidents (Recommendation 4.5b); and
- as long as they are willing to pay their share of the costs, carriers have equal access to terminals, links and traffic control services (Recommendation 4.5c).

We also believe that pricing to cover full costs, when applied intelligently, can offer major benefits in addition to fairness among different groups of users and between users and general taxpayers. Pricing can:

- help ensure that existing infrastructure is used in a way that offers the greatest economic benefit to Canada;

- provide valuable guidance for new investment decisions; and
- provide a basis for decentralizing the operation and management of infrastructure. In the absence of prices for outputs and inputs, it is difficult to give local management the power to decide how many and which services to offer, and which combination of resources to use in the production of services. Decentralization provides greater flexibility to meet local needs and can encourage managers to achieve the lowest cost for operations.

We emphasize that our approach to pricing is not designed to provide infrastructure providers with a means of passing any and all costs on to users. Rather, our approach is designed to ensure that costs are subject to greater discipline and that operating efficiency is increased.

We also want to reiterate that the costs we are discussing are already being paid. They are not new costs. Our concern is that the taxpayer, who may or may not travel, not be saddled with expenses that benefit those who do travel. While our framework will raise the cost to the traveller, we expect that it will lower the burden on the taxpayer.

In this chapter, we explore the costs of transportation infrastructure, how investment decisions should be made to ensure that the appropriate amount of infrastructure is in place, and methods for setting charges. In Chapter 6, we discuss access to infrastructure and the institutional arrangements for its ownership and management.

## TRANSPORTATION INFRASTRUCTURE: AN OVERVIEW

### COMPONENTS OF THE TRANSPORTATION SYSTEM

As we noted in Chapter 2, transportation infrastructure refers to the non-carrier component of the intercity transportation system: terminals, links, and traffic control systems (Table 5-1).

*Table 5-1*

*COMPONENTS OF THE TRANSPORTATION SYSTEM*

| **Mode** | **Carrier** | **Infrastructure** | | |
|---|---|---|---|---|
| | | **Terminals** | **Links** | **Traffic control** |
| **Road** | Cars | Car parking | Roads (including bridges) | Police, road signs and signals, traffic control laws and regulations |
| | Buses | Bus terminals | | |
| **Air** | Airplanes | Airports (including runways) | Air navigation systems | Air traffic control |
| **Rail** | Trains | Stations | Railway tracks | Dispatch, signal systems |
| **Water** | Ferries | Ferry terminals (including wharves and ferry slips) | Waterways and canals (including navigational aids) | Vessel traffic services |

Today, the federal, provincial and territorial governments own and manage most of Canada's intercity transportation infrastructure. The federal government supplies airports, air navigation and air traffic control, and services for water links. Provincial and territorial governments design, build and manage roads and highways. Some carriers own and manage rail tracks and terminals, most bus terminals and some ferry terminals.

## CAPITAL AND OPERATING COSTS

System-wide cost estimates for passenger transportation (Table 3-1, Chapter 3) show that the capital and operating costs of transportation infrastructure are $6 billion per year or, on average, 14 percent of the total cost of intercity travel. This estimate includes an "interest charge,"[1] as well as depreciation on the existing physical capital. Our estimates, however, are only approximate. Governments, which build and own most infrastructure, rarely keep records that show the value of the infrastructure. Our estimates are intended to reflect current replacement costs.

In most cases, intercity travellers share passenger transportation infrastructure with other users. For example, freight and passenger motor vehicles, as well as urban and intercity travellers, use the same roads. It is often difficult to allocate infrastructure costs accurately among the different users. In our calculations, we have allocated the following percentages of infrastructure costs to intercity passenger transportation:

- 70 percent of the intercity road network to passenger vehicles;
- 84 percent of airports and the air navigation system to commercial passenger aircraft;[2]
- 2 percent of the rail network to passenger rail; and
- 12 percent of selected government expenditures for marine links and control systems (primarily aids to navigation and coast guard services) to passenger travel on ferries.

## MAKING INVESTMENTS IN TRANSPORTATION INFRASTRUCTURE

### PRIVATE-SECTOR INVESTMENT DECISIONS

Private-sector companies base their transportation infrastructure investment decisions on expected profitability and a return on their investment. We believe this criterion is appropriate as long as these firms are not making monopoly profits that distort their decisions, and are taking all costs into account, including those related to environmental damage, safety and accidents.

### GOVERNMENT INVESTMENT DECISIONS

In the past, governments have often used transportation as a tool of public policy, making investment decisions that served political, economic and social goals in addition to transportation goals. We believe such goals are inappropriate for the passenger transportation system of the future. Today's passenger transportation system is now mature, and Canadians in most of the country are served by several modes of transportation. Although there may be some areas where new investment is required for expansion, most expenditures are now made to maintain, replace, and upgrade infrastructure. We believe that infrastructure expenditures, if they are to be made by government at all, should, from now on, be made only if they are expected to provide a return on investment.

Two factors determine a return on investment: benefits and costs. While the total expected cost of an investment project is often easy to calculate, the expected benefits are much more difficult to estimate. The benefits for private-sector projects are based on expected increased revenues and cost savings from the investment. Revenues are determined by what people will pay for the new good or service and by how much of it they will purchase.

What are the benefits of a new road or an airport terminal? How can they be calculated? Under our principles, users should pay for what they use, and the price they pay should cover all costs, including those associated with environmental damage, congestion and safety measures. We believe that governments should measure benefits using the same yardstick as that of the private sector: the prices users are willing to pay and the revenues that the infrastructure is expected to generate.

## THE PRINCIPLES OF INFRASTRUCTURE PRICING

The total costs of transportation infrastructure are substantial. At the same time, adequate infrastructure is essential if efficient transportation services are to be available. Excessive infrastructure is wasteful because the resources used could have been used to produce other needed goods and services. In the case of government ownership, excessive infrastructure is thus an unnecessary burden for taxpayers. Yet too little capacity, or capacity of the wrong type or in the wrong place, is also wasteful since it causes delays in the movement of people and goods. These delays reduce the ease of travel, add to the uncertainty and costs of doing business, and thus reduce Canada's productivity and competitiveness.

## EFFICIENT PRICING

**Efficient prices = prices that lead people to travel without wasting resources or losing opportunities**

Efficient prices encourage people to use the road, rail, air and water modes in a way that does not waste resources or opportunities. These prices are also fair if users who are responsible for the same level of costs pay the same amount.

When travellers must pay for all of the costs incurred in producing transportation services, they will balance their use of these services against their costs. They will not use a facility more than they need to, because this wastes their money; nor will they use a facility less, since this wastes an opportunity.

Charges to travellers also test the public's willingness to pay for infrastructure investment. Over time, the capacity of transportation infrastructure requires expansion, contraction or change. Governments should use consistent rules to evaluate new investment projects. Charges provide a means of developing such rules by measuring Canadians' desire for expanding, changing or reducing the capacity of infrastructure or the size of transportation networks.

## MARGINAL COST

### Marginal Cost as a Starting Point

An important starting point in establishing prices for transportation infrastructure is the marginal cost — the additional cost that occurs when there is an increase in the amount used of a product or service, such as a road or a runway.

**Marginal cost = the additional cost that results from a small increase in the amount provided of a product or service**

**Example of a marginal cost: the cost for the wear imposed on a road every time a vehicle uses the road**

For example, the marginal cost of a road is the cost of the wear on the road incurred each time a vehicle uses the road. If operators of vehicles do not pay for the damage they inflict to the road, they have no incentive to reduce vehicle use or to switch to less-damaging vehicles. Generally, when users do not fully pay for the marginal costs of infrastructure — that is, when they face a lower charge than the costs they impose — their transportation choices cost the economy more than the return or value they receive. In our example, if users do not pay for damage to roads, they may choose to make an unnecessary trip, or use a vehicle that is cheaper to operate but causes more road wear. The benefits of such trips to the user are small, but the costs to the taxpayer may be substantial.

### Operational Limitations in Applying Marginal-Cost Pricing

For many types of transportation infrastructure, as in other public utilities such as electrical power and telephone services, marginal costs are difficult to estimate or apply. There are four reasons for this:

First of all, marginal cost may be difficult to measure. For example, analysts may not agree on the amount of damage that heavy trucks impose on different types of roads.

Secondly, marginal cost may vary with circumstances. For example, the amount of damage trucks cause to roads may increase during spring thaw. Or, the cost of handling additional passengers in a terminal may increase if the terminal is already at the normal level of use and extra staff have to be hired. If these variations in cost are predictable, it may be possible to vary prices to match the variation in cost — although changing prices may involve added complexity for the operator of the facility, and for users. Not all such variations in costs, however, are predictable, and transportation providers may not be able to set prices easily or accurately.

Thirdly, electronic technology is sometimes able to provide instantaneous information on variations in cost, and to identify the amount of use by individual users at any given moment. Although users are sometimes in a position to respond to varying prices, there are many circumstances in which fine-tuning prices to match variations in marginal costs is impossible, or not worth the inconvenience to suppliers and users. For example, it may be possible to keep track of variations over the day in the cost of producing electricity — as different cost sources of supply are used. But, for a household, as opposed to a large industrial user, it might not be worthwhile to keep watching the (hypothetical) price meter and adjusting use of electrical appliances as the price changes over the day.

Finally, even where marginal costs can be measured with some precision, infrastructure providers sometimes find it difficult to collect charges from users. Roads, especially those other than limited-access highways, are a good example of this. The main method of charging directly for road use is a type of toll booth. But toll booths, unfortunately, produce additional costs for the road owner and delays for the users. These additional costs would be especially large, relative to the costs of use of the road itself, for short trips using road systems with frequent access points and intersections. For these reasons, toll roads have been the exception rather than the rule, and — if used at all — are used only on limited-access highways. Instead, governments use fuel taxes, which can only be related approximately to the amount of road use and its costs, as the principal means of charging drivers for road use.

Developments in electronics may eventually make it possible, without great expense or invasion of privacy, to identify moving vehicles on a segment of road, and then charge for use. This might be done using an electronic card, for which credit balances could be purchased, and which was automatically debited by signalling devices in, on, or near the road.

## PRICING TO RECOVER TOTAL COSTS

### When Marginal-Cost Pricing Causes Deficits

An important further limitation in applying marginal-cost pricing is financial, rather than operational. In many cases, it costs a substantial amount to provide a basic level of infrastructure such as a two-lane highway or an airport large enough to handle certain types of aircraft. The marginal costs associated with additional users, however, may be small.

**Example of how marginal-cost pricing can result in a deficit:**

- **A facility serving 100 users costs $1,000 per day, for an average cost of $10 per user.**
- **It costs only an additional $5 to provide service to each user after the first 100 users.**
- **If there are 200 users a day, the total cost is $1,000 for the first 100 users and $500 for the additional 100 users. The total is $1,500, or an average cost of $7.50 per user.**
- **If the price for all users is set at the marginal cost — $5 — revenue would be only $1,000, resulting in a deficit of $500.**

Transportation infrastructure pricing involves a difficult choice when marginal cost is less than average cost, a situation that can arise when producing the service requires an expensive basic facility whose capacity can be expanded cheaply. To charge more than marginal cost is not efficient because some potential users, who would have been willing to pay the marginal cost and who would have gained from using the facility, would not do so at the higher price. This non-use means a loss to the economy. And yet setting the price equal to marginal cost means a financial deficit in operating the facility.

If a government decided to set prices equal to marginal costs, and to accept the financial deficit, general taxpayers would then be financing the deficit and would in effect be paying for a part of the provision of benefits to users. The results of this are:

- a transportation system that violates our principle of fairness to taxpayers, users and carriers;
- a need for higher general taxes, which causes distortions in price-cost relationships elsewhere in the economy that will, in turn, cause losses of benefits to the economy; and
- pressures for government intervention into the management of that infrastructure requiring subsidies. Such intervention may reduce the pressures for cost efficiency that would occur if the infrastructure was run on a more commercial basis.

As well, in making investment decisions to add or close infrastructure, it is necessary to test how much users value the basic infrastructure, not just how much they value additional amounts of service or use. Marginal-cost pricing does not provide a complete test.

On balance, we favour a policy under which users pay the full cost of the infrastructure they use, assuming that such costs are no higher than necessary. In many cases, this policy of full cost recovery may require prices to be set above marginal cost.

### Pricing to Avoid Deficits

There are several ways of pricing that enable infrastructure owners to achieve full cost recovery:

*Setting prices equal to average costs:* This approach is not as simple as it appears. There may be different categories of users, such as vehicles that take up different amounts of space and/or have different weights. The average cost could be calculated by the total cost divided by number of vehicles, by total square metres occupied by all vehicles, or by total weight of all vehicles. Each calculation would result in different charges for each category of vehicle, and thus in a different pattern of use.

*Determining responsibility for costs:* Careful consideration of costs associated with different types of users may provide a better basis for allocating total costs than some simple average. For example, if heavier or larger vehicles require a road or runway to be built to a higher standard, the extra costs of building to the higher standard can be assigned to heavy vehicles when setting prices. If more capacity is needed to serve users at peak periods, these users can be charged an additional amount to cover the extra cost.

*Pricing according to benefits:* Prices incorporating costs that can be directly attributed to particular groups of users may still not cover total costs. One could set prices in a way that least reduces the use of the infrastructure and thus minimizes the economic loss associated with a reduction of use. If this were done, the benefits obtained by various users, as well as the costs for which they are responsible, would determine the price.

One option is to use a mark-up over marginal cost that varies with the extent of benefit. The benefit could, in principle, be measured by how much the use of the facility by a group of users declines as the price increases. The smaller the decline, the more the group appears to value the benefit of use. This option is related to the practice known as "value of service pricing" or "charging what the market will bear." Railway companies, whose average costs are generally higher than their marginal costs, traditionally use this type of pricing when setting freight rates for different categories of products.

Our principles do not support unconstrained charging of what the market will bear. Rather, we intend that infrastructure providers charge a sufficient amount to cover full but efficient costs.

*Two-part pricing:* With this approach, infrastructure providers charge one amount for the right to use a facility — such as an annual fee — and a second charge on a per-use basis. This system is found at some golf courses that charge an annual membership fee as well as "green fees" for every round of golf played. A transportation example of two-part pricing is the annual car licence fee, coupled with a fuel tax that varies according to use. The per-use fee can be set at, or moderately above, marginal cost, and the annual fee can be used to cover the gap between total cost and revenues generated by the per-use charges. The annual fee may also differ across classes of users, depending on the benefits that each group derives from the infrastructure.

**Recommendations for Pricing**

As part of Recommendation 4.8 (Chapter 4), we propose that prices be set to encourage neither over-use nor under-use of transportation infrastructure. In addition, we suggest that where such prices do not recover full costs, they be adjusted to cover this cost so as to minimize the loss of efficiency. In this chapter, we have argued that setting prices equal to marginal costs encourages the appropriate amount of use of a facility. We have also discussed the general options available to achieve full cost recovery where setting prices equal to marginal costs would not cover total costs.

We realize that infrastructure owners will be required to make shrewd assessments when selecting appropriate prices for individual facilities. They will have to decide how far to go in developing finely tuned prices by balancing the benefits of more accurate incentives against the costs of greater complexity in compliance and administration. Those who wish to raise prices above marginal-cost prices must assess which pricing approach will least discourage use. At the same time, they must decide on the fairness of imposing different prices on various groups of users. We believe that marginal cost should be the starting point to guide transportation infrastructure pricing policy. Where required to achieve full cost-recovery, mark-ups over marginal cost and/or entry fees should be set, taking account of benefits to different classes of users.

## PRICING NETWORKS

Two types of transportation infrastructure — links and terminals — can be grouped into networks. For example, the road links in the Trans-Canada Highway make up a network, as do the road links in the non-urban road system of a province or territory, the route links in the air navigation system, or a group of airports used by commercial air carriers.

When owners provide a network of links or terminals, they tend to apply a common pricing formula to the entire network or major portions of it, rather than set individual prices based on the costs and demands associated with each link or terminal. For example, motor fuel taxes, which we view as the main charge for the road network, have a common basis within a province. For a given type of vehicle, the effective charge is almost constant per kilometre travelled, and does not vary with the cost of, or demand for, the section of road being used. Another example is the Air Transportation Tax, which is the primary charge for the air navigation system. It is not closely related to costs of, or demand for, the air navigation services provided on particular flights since it is a charge on each passenger and results in higher charges for larger airplanes.

### The Stand-Alone Approach

Under our principles, travellers and carriers should pay the cost of the infrastructure they use. Should this coverage of costs apply to the network as a whole, or to as small a segment of the network as is practical?

In Chapter 4, we stated our preference for the stand-alone approach — users pay link by link or terminal by terminal.

The stand-alone approach is consistent with the principle that individual travellers and carriers pay the costs of infrastructure provided for their use. It also eliminates cross subsidies from one link or terminal to another, either within a mode or between modes.

Individualized pricing tests users' willingness to pay, and provides valuable information for decision makers who are considering the addition, expansion, or abandonment of links or terminals. If prices are set on a network-average basis, potential users of a proposed high-cost link or terminal may want its construction even though its benefits would not be worth its full costs. They know that such an addition will have a minimal impact on the network's average cost, which is all they will have to pay.

Prices related more closely to actual costs send the right economic signals to travellers in their choices of route. For example, the wear imposed by heavy trucks on roads is substantially less on main highways that are built to higher standards than it is on secondary roads. If a standard charge per kilometre for a given type of vehicle is applied, equal to the average cost of wear by that type of vehicle over the whole network, the charge will be greater than the actual cost of wear on main highways and less than the actual cost of wear on the secondary roads. The failure to relate charges to actual costs will tend to lead truck operators to choose routes that are inefficient to the economy when all costs are taken into account.

Setting average prices over networks consisting of high- and low-cost routes can also lead travellers to a choice of modes that is not beneficial to the economy. If such prices are different from route costs, users on a given route may be induced to choose a mode that has higher costs to the economy for that route.

The arguments in the preceding two paragraphs are subject to exceptions. These arguments are based on prices being better aligned to marginal cost under the stand-alone approach. However, given the frequent need for a mark-up over marginal costs to cover full costs, and the fact that the required mark-up may vary from link to link or terminal to terminal, prices under a stand-alone system may not always be closer to marginal costs for the different units than under a network-average pricing system.

Current practices in individualized pricing, and the practicality of moving toward such pricing, differ substantially across the modes and the various facilities that they use. For example, bus terminals are effectively priced on an individual basis, while a user of the road system generally pays an almost constant charge per kilometre for a given vehicle anywhere within a province.

In the following sections, we apply our general pricing principles to the terminals, links and control components in the different modes and discuss how far and how fast the stand-alone approach might be implemented. We do not illustrate potential charge levels. We discuss charges for environmental and accident costs in Chapters 7 and 8 and draw overall conclusions in Chapter 18 as to the set of charges that users of a mode might pay.

## APPLYING THE PRINCIPLES TO TERMINALS

### BUS TERMINALS

Current pricing for bus terminals is close to the stand-alone approach that we recommend. In many cases, intercity bus companies own the terminals and face the full cost of providing services. Where municipalities own terminals, the terms that individual carriers negotiate likely reflect some combination of the costs of using a terminal and the benefits of that use to the carrier.

Bus terminals vary in size and, in a few cases, are integrated with terminals for other modes of intercity transportation. For example, the terminal can be a simple passenger pick-up and drop-off point next to a rural gas station or urban hotel. In other cases, central bus terminals in major cities provide passengers with a substantial range of supplementary services ranging from restaurants to newsstands.

Under our principles, there should be open access to essential infrastructure for all carriers prepared to pay for their cost. We believe that in most locations potential operators have sufficient options to obtain space in, or to create new, terminal facilities. We are not concerned about monopoly power in such situations. In cases where access to a single terminal is of critical importance, however, a referee may be desirable, especially where the terminal is also owned by a major carrier. Federal legislation and policy on competition provide some protection of access rights for competitors when a major carrier owns a terminal, but such rights may require reinforcement.

## RAIL STATIONS AND FERRY TERMINALS

Rail stations and ferry terminals, which are also frequently owned by carriers, do not raise any issues additional to those we have addressed concerning bus terminals.

## AIRPORTS

### Current Pricing

Transport Canada owns and operates the majority of Canadian airports serving scheduled air carriers. The primary charges are landing fees set according to a schedule that varies little from airport to airport. The federal government has also allocated a share of revenue from the Air Transportation Tax to cover the costs of the entire airport network. Revenues from concessions at airports also cover some airport costs.

The recent federal initiative to lease Transport Canada airports in Vancouver, Calgary, Edmonton and Montreal to newly created Local Airport Authorities (LAAs) should help move airport pricing in a direction that is more consistent with our pricing principles. The LAA airports will, after a brief transition period, have to recover full costs from users, including operators of concessions. The LAAs will not receive any share of the Air Transportation Tax and will set landing fees and possibly passenger facility charges according to their individual requirements.

Once an airport terminal is built, marginal costs for use by an additional aircraft with passengers are often low. Therefore, charges should also include some amount for the value of the service provided to the passenger. Aircraft weight may be a reasonable indicator of this value.

At airports, the demand at peak periods can strain capacity and may lead to expensive investments for expansion. In such cases, higher prices for peak-period users — aircraft and/or passengers — could encourage the highest-value use of the existing infrastructure and provide a test of the value that users attach to expansion investment.

### Applying the Stand-Alone Approach

To find out how charges would vary by type of airports, if all airports operated on a stand-alone, full cost-recovery basis, we obtained estimates of the full costs attributable to commercial aviation at 98 airports owned by Transport Canada, as well as the current revenues obtained from landing fees and terminal charges. Table 5-2 presents these estimates for five categories of airports:

I. Vancouver and Toronto (which are the two largest airports and the ones currently closest to full cost-recovery).

II. The next six largest airports (in passenger capacity).

III. The next 20 airports (in passenger capacity). These airports were designed to handle more than 200,000 passengers per year.

IV. Twenty-six airports (generally serving smaller cities and towns, but oriented to scheduled commercial aircraft).

V. The remaining airports that also serve smaller cities and towns. (These airports are often in northern areas; some are not oriented primarily to commercial aviation. The estimated costs per commercial passenger for this group are less reliable.)

*Table 5-2*
*Summary of Airport Cost Recovery, 1988*

| **Airport category** | **Number of airports** | **1988 Enplaned/ deplaned passengers (millions)** | **Cost attributable to commercial aviation (airlines)[a]** | | | **Full cost[c] less revenue from commercial aviation per passenger[a] ($)** |
|---|---|---|---|---|---|---|
| | | | **Full costs[b] ($ millions)** | **Operating costs per passenger ($)** | **Full cost per passenger[b] ($)** | |
| I. | 2 | 29.1 | 310 | 2 | 11 | 6 |
| II. | 6 | 22.9 | 350 | 3 | 15 | 10 |
| III. | 20 | 7.4 | 160 | 9 | 21 | 18 |
| IV. | 26 | 2.2 | 100 | 18 | 46 | 44 |
| V. | 44 | 1.2 | 180 | 51 | 146 | 140 |
| **Total** | **98** | **62.8** | **1,100** | **5** | **18** | **13** |

**a. 1988 cost and revenue estimates are in 1990 dollars.**

**b. For categories I, II and III, full costs include an approximate allowance for land costs of $5 per passenger. See Notes to Chapter 3 in Volume 2.**

**c. Full cost per passenger from previous column.**

We first discuss the airports in categories I to IV, given the special circumstances of many airports in Category V.

If charges were set to fully recover costs in the first four categories of airports, there would be an appreciable increase in the cost of air travel for users of the airports in Category III and especially Category IV. Under full recovery of present levels of costs, charges per passenger, on average, would increase by the amount shown in the final column in Table 5-2. These charges, however, would not necessarily be applied directly to passengers as a uniform per-passenger charge equal to the average amount shown. Some of these costs would be incorporated in landing fees charged to the carrier and/or in terminal fees charged to carriers or passengers. Charges may be direct to the airline but are then reflected in the traveller's ticket price. It should be noted as well that, from the traveller's point of view, the overall increase in prices would be offset to some extent by eliminating the portion of the Air Transportation Tax currently assigned to airport funding.

The federal government, however, did not build these airports with the intent of full cost recovery, and the airports are run under a centralized system that does not pressure management to find innovative ways of achieving cost savings and of increasing revenues. If management operated airports with greater efficiency and lowered operating costs, the increase in average charges would not be as large as the amounts shown.

We note, for example, that Oshawa Airport, which is not federally operated but is locally run, handles about the same number of passengers as the smaller airports in Category IV and covers its operating costs with charges to travellers.[3] Although there are many important differences[4] between the two airports, a comparison between Oshawa and the Transport Canada-operated airport at Yarmouth is interesting (Table 5-3).

*Table 5-3*
*COMPARISON OF YARMOUTH AND OSHAWA AIRPORTS, 1987*

| | **Yarmouth** | **Oshawa** |
|---|---|---|
| **Annual operating deficit ($)** | 700,000 | 0 |
| **Operating hours (per day)** | 9 | 16 |
| **Total movements (per year)** | 10,000 | 98,000 |
| **E/D[a] passengers (per year)** | 35,000 | 38,000 |
| **Staff** | 20 | 3 |

**Source: See endnote 3.**

**a. Enplaned, deplaned passengers.**

The airports in Category IV, on average, cover only 14 percent of operating costs with charges to travellers. We believe that if these airports were run locally, had to meet costs through charges to travellers, and were not subject to central policy requirements more appropriate for larger airports, they could eventually reduce operating costs substantially. The result would be terminals that are less expensive and better matched to the level of services required by the community.

### Recommendations for Airport Pricing and Investment

Investments, such as new runways at airports, should be made according to our principles. The federal government is proceeding with the necessary studies in order to build three new runways at Lester B. Pearson International Airport and two at Vancouver International Airport. The full costs of these projects, including interest charges, should be recovered from the users of these airports. Even though the federal government has progressed beyond the point of initial consideration, it nevertheless should apply our principles to these major investments.

We **recommend** that:

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**5.1 (a) Airport pricing and investment be on an airport-by-airport basis; and**

**(b) The Air Transportation Tax not be used to help fund airports.**

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We recommended in Chapter 4 that government provide financial assistance, on a declining basis, to ease adjustment in situations where applying our principles would result in steep price increases.

Therefore, we **recommend** that:

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**5.2 Where applying our principles to airports, including all Transport Canada airports, would result in steep increases in average charges to travellers, governments provide transitional assistance:**

**(a) at an initial level based on the current subsidy of operating costs;**

**(b) to be phased out over 10 years;**

**(c) to be used for capital as well as operating expenditures; and**

**(d) if the airport is closed, to be used locally for other transportation purposes.**

---

As we noted, governments built some airports on a larger scale and to a higher standard than was necessary, and with the expectation that taxpayers and not travellers would pay for the costs. In commercial terms, it makes no sense to try to recover the full capital costs of such existing airports. A write-down in value is necessary, and Transport Canada's charges to the airport authority for capital costs should reflect this write-down. If the federal government decides to turn such an airport over to a local authority, it may in some cases be appropriate to transfer it without charge. Any new investment, however, should not be made unless the prices to be charged can be set in such a way as to provide a positive return on the investment.

We therefore **recommend** that:

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**5.3 (a) The valuation of existing airport capital facilities used for establishing charges to travellers, and for transferring the airport to local airport authorities, reflect the commercial potential of the airport, not historical costs; and**

**(b) New investments be made in an airport only when costs, including a return on the investment, are expected to be repaid through future revenues.**

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According to our estimates, airports in Category V have extraordinarily high costs per passenger. Passing on such costs to travellers would cause a sharp curtailment in use. While it is possible to run many of these airports in a more cost-efficient manner, especially if requirements more appropriate for larger airports are removed, we realize that several airports may have no prospect of survival on a stand-alone commercial basis.

Governments may wish to retain some of these airports for reasons of national defence, health services, emergency evacuation, or other purposes not related directly to providing passenger transportation. In such cases, governments should support the airport with general taxpayer-financing and indicate clearly the purpose of the airport and the financing of it. Airport management should also allow commercial aircraft to use the terminal when this is compatible with the purpose of the airport. Charges for such services should include the cost of any extra facilities provided and should not be less than the levels of charges at small but financially self-sustaining airports.

Where governments judge that there is insufficient reason, on grounds other than commercial transportation, for keeping the airport open, they should apply the general transition mechanism that we suggested for other airports — a subsidy sufficient to avoid sharp initial increases in charges, but phased out over 10 years. Governments should not undertake any new capital spending that cannot be recovered from future revenues. The terms of transfer of the airport to a local operator should reflect the airport's commercial value, which may be well below its historical cost. At some stage in the transition, it may become clear that an airport is not viable and should be closed.

## APPLYING THE PRINCIPLES TO LINKS

### THE ROAD NETWORK

Until the beginning of the 20th century, roads were a necessary, but secondary, means of transportation compared with rail and water. The advent of the automobile and truck caused this form of infrastructure to come to dominate our transportation system and restructure Canadian lifestyles. One significant change was in the method of funding roads. While there was a mix of public and private infrastructure before 1900, after that date, nearly all roads outside of dedicated logging and mining infrastructure were provided by local and provincial governments. Most of the developing system was also provided free of direct charges, and today there are only three toll bridges and one toll road in the entire country. (Including international toll bridges and tunnels in the count would boost the number.)

Since the 1920s, although some of the cost of roads has been offset by fuel taxes and by specific property assessments for municipal upgrading, the road system has essentially been built by government departments financed through general taxation. This situation has begun to change because technology has made it possible to levy charges directly against users. Charges or taxes on fuel consumption in Canada are now partway between those in the United States (low) and Europe (high), and go a substantial way toward offsetting the cost of today's system. Electronic road pricing[5] is technologically feasible, and we believe it will be introduced in some countries in the next two decades. In the United States and other countries, examples exist of automatic toll facilities, reading electronic toll tags.[6] The move from general revenue-based subsidies to a pay-as-you-go system of road pricing is possible now, and some move to link-by-link pricing is feasible in the near future.

### Fuel Taxes and Licence Charges

We realize that applying our pricing principles to road links will be gradual. Our cost analysis also suggests that a large increase in charges is necessary if users are to pay for the road system. Initially, the shift to a pay-as-you-go system should be achieved through increases in the existing fuel taxes and licence charges, which are generally set on a province-by-province basis. Governments should identify and set aside the infrastructure component of these charges (Chapter 6). We do not want higher fuel taxes and licence fees to be added to the existing tax structure and thus form additional, windfall revenue for governments. We strongly believe that increases in fuel taxes and licence charges should be offset by reductions in the general taxes that currently pay for most road costs.

Canadians, as travellers and as taxpayers, are already paying for total road costs; we are advocating a shift from tax dollars to charges to travellers, not an increase in the total burden.

The marginal cost of road use by cars is low. Marginal-cost pricing would not cover full costs, but using fuel charges to cover full costs, or some other basis that relates charges strictly to distance driven, would tend to discourage road use more than is necessary.

We have examined different pricing approaches that would set a fair charge for cars and still cover road costs:

- Using only fuel taxes to recover road costs would result in a substantial increase above marginal costs in the road component of fuel taxes, thus discouraging road use.
- Raising licence fees would lessen the increase required in the road component of fuel taxes and might discourage road use less.

- Licence fees might also be set according to the value of benefits received — for example, higher licence fees would be charged for heavier and/or higher-priced cars if authorities judged there to be an association between the price of the car and the owner's valuation of the opportunity to use the roads. Any such approach would inevitably have to be based on use of a rough indicator — such as car weight or car price — of the value of benefits received.

When road owners set road charges to travellers, they must also include charges for environmental and accident costs. The current system of charging for accident costs involves an annual insurance premium that varies little, if at all, with annual distance driven. The result is that, for each additional kilometre that road users drive, they face less than the marginal costs of the accidents they impose. As noted earlier, however, using the fuel tax as the main road charge for cars is almost certain to cost travellers substantially more than marginal road-use costs. Therefore, the low marginal charges for accident costs would tend to offset the excess marginal road charges collected through a fuel tax. This balance lessens concerns about continuing to depend on annual insurance premiums and fuel charges to efficiently allocate road capacity.

We believe that charges on fuel will be used for some time to cover a major portion of road costs. As we shall discuss in Chapter 7, fuel taxes may also be appropriate as a means of charging for environmental damage. If transportation is to pay its costs but not more than its costs, and if governments are to treat the different modes equally, there should be no special taxes on transportation that are above the taxes or charges required to meet infrastructure, environmental, safety and accident costs.

Therefore, we **recommend** that:

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**5.4 All fuel taxes be used for transportation purposes or as a means of charging for costs caused by transportation, such as environmental damage and the health care system costs.**

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Since the federal government provides few roads, the federal excise tax on gasoline and diesel fuels should be withdrawn except to the extent that it proves to be an appropriate environmental charge. Provincial taxes on fuel used by rail and air, for which provincial governments provide few services, should be withdrawn except to the extent that these taxes prove to be appropriate charges in environmentally sensitive regions for which provinces take responsibility (Chapter 7).

### Charges for Heavy Road Vehicles

Trucking was not specified in our mandate, but our proposal to recover road costs from users requires an appropriate division of those costs among cars, buses and trucks. Costs of road wear are generally much greater from heavy trucks than from cars, but different trucks impose different costs. Even though current provincial/territorial truck registration fees rise with truck weight, estimates prepared for the Royal Commission (Volume 2) suggest that heavy axle-weight[7] trucks currently pay less than their total cost of road wear. They may, in some cases, impose greater costs per vehicle-kilometre in terms of road wear alone than they pay in fuel taxes per vehicle-kilometre.

For heavy vehicles, we suggest adding an axle-weight and distance tax to the fuel tax to bring the total charge at least up to the marginal costs they impose. By aligning total charges more closely to the wear imposed by trucks with different weights and axle/tire configurations, the additional charge would encourage truck operators to choose vehicle types and loading practices that imposed less wear on roads. In addition, the charge would achieve more equal treatment of trucks and rail in the movement of freight, as rail freight generally covers its full costs.

Therefore, we **recommend** that:

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**5.5 Provincial and territorial governments institute weight-distance taxes for trucks as part of an overall road-financing program.**

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### Conventional Toll and Electronic Road Pricing

While we realize that fuel taxes, weight-distance taxes and licence fees applied provincially or territorially will constitute the major charges for road use in the future, specific link-by-link charges more fully reflect our principles and are already practical in some cases in their traditional toll form.

Therefore, we **recommend** that:

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**5.6 Conventional tolling systems be considered when new or expanded limited-access highways are required, with tolls set to cover any costs of the road link in question that exceed those recovered by fuel taxes.**

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In addition, governments could use tolls to levy a higher charge on peak-period users if congestion is a problem on a road. Toll roads should also provide an opportunity to test and improve electronic systems for identifying and charging for vehicle use.

### Longer-Term Directions of the System

Over the longer run, we expect that developments in electronics will make it inexpensive to identify vehicles, record locations and times of road use, and charge accordingly. We suggest that governments give serious consideration to a system in which charges per vehicle-kilometre vary by vehicle type, road used and time of use. When it becomes technically possible to apply a pricing structure of this type, the benefits of doing so should be weighed against any disadvantages (increased complexity for travellers, for example). The benefits from individualized pricing are greatest where costs, especially marginal costs, differ substantially among route links and where travellers' decisions are likely to be significantly affected by differences in price. Where cost differences are modest, a system of common rates of charge for substantial groupings of road segments and vehicles may provide the simplest solution.

The use of light vehicles on low-volume rural roads and other local access roads may generate marginal costs much lower than the average costs per vehicle-kilometre. The result is that, to cover the full costs of the road, users would have to pay high charges. We believe there is no point, once a road exists, in wasting opportunities by discouraging road use. Local property taxes, or other local taxes levied on those who receive the primary benefits from such roads, may be an appropriate source of funding for part of the costs. Governments will need to reconsider such sources of funding as the pricing of the road system moves toward a link-by-link basis.

## AIR LINKS: NAVIGATIONAL AIDS

Air links are serviced by the navigational aids used by scheduled commercial and other aircraft. Inter-airport air traffic control, especially as it evolves toward a highly automated system, can also be treated as part of air links for pricing and investment purposes.

The cost of the air navigation system involves a large capital component with almost no extra costs to add more users. Therefore, charges will have to be set above marginal costs if total costs are to be recovered. The excess of charges over marginal costs should be related to the users' valuation of their benefits. Pricing in this way would minimize the extent to which charges that recover full costs cause aircraft operators and potential operators to forego use of the facilities. Pricing based on distance flown and size of aircraft is one way of recognizing the value of benefits received. Governments may also institute a two-part pricing system based on a membership fee for aircraft operators plus a fee for each use.

### Recommendations for Air Links

Currently, the costs of the air navigation and traffic control systems would almost be covered by the Air Transportation Tax if all of it were allocated for these purposes. But the basis for charges under this tax, which is levied on airline passengers, is not related closely to costs imposed by the aircraft, or distance flown and size of aircraft. In addition, the charges should be levied on aircraft operators, who in turn will pass it on to passengers, since carriers and other aircraft operators make decisions about air navigation system use.

Therefore, we **recommend** that:

**5.7 A system be developed that charges aircraft operators directly to cover the cost of air navigation and traffic control. The charge should reflect costs attributable to the type of flight and class of aircraft, and value of benefits received. This system would replace the Air Transportation Tax.**

As suggested above, the basis for appropriate charges is likely to involve a combination of distance flown and size of aircraft. It may also reflect the aircraft's route or the region over which it is flying.

## RAIL LINKS

Pricing the use of rail track involves issues similar to pricing roads. With rail, however, the systems are already in place, or could be readily put in place, to allow charges to be based on the rail link used, the time of use, and the speed and weight of the train that causes wear. Railways that own their own track pay its full cost, and presumably respond to marginal costs in making pricing and operating decisions. The component of the cost of track (approximately 5 percent) represented by VIA Rail's payment, including incentives, to CN and CP for track use varies to a limited extent with tonne-kilometres travelled, depending on the link.

## WATER LINKS

Links for ferries and other vessels are open water and buoyed (and sometimes dredged) channels. The costs of water links may vary little with changes in the level of use, thus the marginal cost may be low relative to the average cost.

To minimize discouragement of use, the federal government should apply a pricing approach for water navigation links similar to that for air navigation. Charges should reflect the costs associated with different groups of users and the value of benefits received. Savings in operating cost and safety presumably vary with the size of the vessel and the distance travelled. Where practical, charges should also reflect the different navigation system costs associated with different routes or regions.

The portion of total government water navigation costs attributable to ferries is low, and we are not suggesting a special system for ferries. Currently, there is little or no recovery of water navigation costs from ferry operators and other users, but Transport Canada has made proposals to move toward recovering a substantial portion of these costs. Ferries would come under the proposed cost-recovery system in the same way as other commercial vessels, and we suggest that policy makers examine the pricing approaches we have recommended when putting such a system in place.

## APPLYING THE PRINCIPLES TO CONTROL

"Control" is the directing of traffic and policing of terminals and links. In each mode, control services involve a mix of capital and labour costs. Usually, costs are more closely related to the maximum number of vehicles the particular facility can handle than to the actual number of vehicles operating below the maximum. For example, the cost of handling one more motor vehicle, airplane, train or ship within capacity limits is likely to be small. If demand for services changes significantly, however, capacity should be adjusted, with a corresponding change in costs.

Use and provision of control services are often closely associated with use and provision of links, and it may be practical to combine the administration of pricing for links with that of control. Some control cost components are route-specific and, where practical, could be an element in establishing route-specific charges. Other control costs may not be closely related to activity on individual routes and will have to be divided among all users of a network. For example, a component of the fuel tax might be used to charge users of a provincial or territorial highway system for the costs of their police forces.

# ENDNOTES

1. There are two methods of accounting for capital costs: investment expenditures can be included in total costs in the year in which they are made, or they can be amortized over time in such a way that the stream of annual "depreciation charges" and of annual "interest charges" (or return on capital) has the same discounted present value as the initial investment expenditure. The latter approach gives a smoother stream of annual costs and provides a better estimate of the cost of using the facility in a particular year. The Royal Commission's cost analysis work uses this amortized cost approach; a real rate of return of 10 percent, applied to one-half the replacement value of the facility, is used to estimate the "interest charge."

2. The balance is attributed to general aviation. Costs of military and other government use of air infrastructure are excluded from the total being allocated.

3. Gordon B. Hamilton, "Cost Competitiveness of Canadian Airports," paper presented to Air Transport Association of Canada 57th Annual General Meeting, Vancouver, Canada, November 10-12, 1991.

4. Yarmouth has 6,000-foot (1,800 metres) and 5,000-foot (1,500 metres) strips that are 150 feet (45 metres) wide to accommodate DC-9 aircraft; Oshawa has 3,400-foot (1,000 metres) and 2,670-foot (800 metres) strips that are 100 feet (30 metres) wide to accommodate DHC-8 aircraft.

   Yarmouth is 350 km from the nearest alternative paved facility; Oshawa is 65 km.

   One fifth of Yarmouth's annual operating costs are attributable to its full on-site Emergency Response Service (which is not required under national safety standards); Oshawa depends on the local fire department.

   Control-tower costs from the longer operating hours at Oshawa are not reflected in the airport's accounts.

   Yarmouth faces frequent heavy snow; at Oshawa it is rare, and clearance is not so urgent.

   There is a 5-year-old terminal at Yarmouth; Oshawa representatives are asking the federal government to build a terminal there.

5. Electronic road pricing refers to systems that are able automatically to recognize the existence of a vehicle, and to apply a charge that may vary with location and time. The vehicle might carry a pre-paid "debit card" in the form of an electronic tag, from which the charge was deducted automatically; or an automatic link might allow the owner's bank account to be debited; or the system might send the owner a bill, like other utility bills.

6. Examples are: on Oklahoma turnpikes, the Dallas North Tollway in Texas, and the Crescent City Connection Bridge, New Orleans, Louisiana. European examples include the Oslo and Trondheim Toll Rings in Norway, the Autostrada connecting Milan, Florence, Rome and Naples in Italy, and the ACESA highway in Barcelona, Spain. These and other systems are described in T.D. Hau "Congestion Charging Mechanisms: An Evaluation of Current Practice," Transport Division, Infrastructure and Urban Development Dept., The World Bank, draft report March 23, 1992.

7. "Axle-weight" is a customary abbreviation to describe the features of heavy trucks that determine the load they impose on road structures. In reality, loads vary with a number of vehicle characteristics in addition to the number of axles, including the number and width of tires, the spacing of the axles, and the nature of the suspension. Charges should take account of as many of these aspects of truck configuration as is practical, as well as the distance travelled.

# CHAPTER 6

# MANAGING TRANSPORTATION INFRASTRUCTURE: THE INSTITUTIONS

## INTRODUCTION

In Chapter 4, we applied our principles to transportation infrastructure such as terminals, links and traffic control. We observed that:

- since carriers and other users will be asked to pay the full cost of transportation infrastructure, it is particularly important that what is provided is only what is needed;
- where there is an adequate degree of competition among various facilities in a regional market, the forces of competition should be allowed to determine levels of investment and charges, provided that such charges include the costs of accidents and environmental damage; and
- where competitive forces are not sufficient and/or users are in a weak bargaining position, regulation of prices and investment will be necessary.

Under our principles, we noted that governments would act primarily as referees in the passenger transportation system. Their role would be to:

- set and enforce standards;
- maintain competition, including assuring access to monopoly facilities by competing carriers;
- regulate prices charged by monopolies; and
- provide for research, accountability and transparency.

Where a government continues to own or operate transportation infrastructure, its refereeing responsibilities should be at arm's length from its ownership and operating responsibilities. Appointing a referee should be done in a way that enhances the referee's independence and ensures the arm's length relationship.

In Chapter 5, we developed pricing and investment approaches for infrastructure that would best achieve our objectives of fairness and efficiency. We recommended that when governments or industries consider investing in such infrastructure, they use benefit-cost analysis where, if possible, prices and revenues provide the basic measure of benefits.

In this chapter, we turn to the question of who should make investment decisions, set prices, and manage, build and maintain transportation infrastructure. We consider which features of institutions would, in general, help achieve the principles we set out in Chapter 4. We then consider a number of major institutional issues concerning specific types of infrastructure, including:

- the ownership and management of airports;
- the ownership and management of the air navigation system;
- the type of government institution that could be responsible for roads, and a possible national highway system; and
- the ownership and management of rail track.

## ALTERNATIVE INSTITUTIONAL ARRANGEMENTS

Where transportation infrastructure is provided on a monopoly or near-monopoly basis, government intervention in pricing and investment may be required. Monopoly owners can charge higher prices than those required to recover an efficient level of costs, including normal profits. These higher prices can, in turn, lead to smaller facilities, or less use of facilities, and less use of the mode of travel, than in non-monopolistic situations. Our concerns over monopoly profits apply to both privately owned and government-owned infrastructure. In the latter case, the infrastructure manager may have monopoly power over prices and little incentive for profit. This reduces the pressure to keep costs under control.

Where monopoly power is a concern, the challenge is to establish mechanisms that limit the exercise of this power without reducing the pressure for public and private firms to provide their services efficiently. There are many types of institutions that can regulate or intervene in monopoly or near-monopoly situations. In some cases, government institutions monitor private companies; in others, independent institutions monitor public companies.

## PRIVATE-SECTOR PROVIDERS OF TRANSPORTATION INFRASTRUCTURE

### Examples in Canada and Other Countries

The private sector provides transportation infrastructure largely to meet carriers' needs. Railways tend to own their track, bus companies generally own their terminals, and ferries frequently provide their own docks and wharves. While few carriers own air and road infrastructure, in the United States major air carriers have entered into residual financing arrangements with airport authorities. Under such arrangements, an airline assumes the airport's financial risk in return for long-term agreements that provide it with considerable control over investment and operations at the airport.

Governments in several countries have been attracted by the prospect of private-sector ownership of transportation infrastructure as commercial ventures. France, Italy and Spain have set up extensive systems of tolled highways under private or mixed ownership. The United Kingdom and some U.S. states, notably California, have invited private firms to participate in developing and operating a number of tolled roads, bridges and tunnels. In 1987, the governments of the United Kingdom and France awarded a monopoly franchise to a private company, Eurotunnel, to build and operate a 50-kilometre rail tunnel between Dover and Calais. There are also examples of private-sector involvement in airports.

The fixed crossing under consideration between Cape Tormentine, New Brunswick, and Borden, Prince Edward Island, is a potentially important Canadian experiment in private-sector involvement in a transportation link. The federal Department of Public Works has received bids from private-sector consortia that are prepared to build the crossing, operate it for 35 years and then transfer it to the Department. The project, estimated to cost up to $1 billion, is to be privately financed. Private investors will derive revenue from toll charges to be indexed to the provincial Consumer Price Index and from a 35-year federal subsidy. This subsidy is not to exceed the estimated cost to the federal government had it continued to operate the Cape Tormentine to Borden ferry service at the current subsidy level plus inflation.

Are private firms more efficient than governments in providing transportation infrastructure? In the case of European toll roads, where governments have had extensive experience with private-sector involvement, the evidence is mixed. Private firms appear to have performed well in managing road construction, but governments have had difficulty establishing long-term arrangements that offer sufficient incentive to private companies to maintain such roads and operate them efficiently.[1]

We also note that efficiency is not necessarily the main reason that governments turn to the private sector to provide this infrastructure. Governments are attracted by the opportunity to avoid borrowing, rather than by the possible gains in efficiency that result from transferring investment decisions and risk-taking to private operators.

### Problems with Private-Sector Providers

We believe that private ownership of transportation infrastructure can be compatible with our principles with respect to pricing and equal treatment of the modes. Transportation infrastructure, however, often requires large amounts of highly specialized investment. The result is that, in some cases, owners may gain considerable monopoly power. Government regulation will often be necessary to control the power of private firms, or autonomous public firms, and to ensure that carriers have equal access to infrastructure.

Problems of equal access arise particularly when a carrier, or a number of carriers, own or control infrastructure and can prevent entry by potential competitors. At some U.S. airports, a single carrier may have substantial influence under the residual financing arrangements. There, major carriers with long-term exclusive leases and the sole right to use scarce airport gates may block expansion of the airport and thus impede the entry of new carriers and competition.[2]

Problems of access are not exclusive to transportation, but arise in other industries such as electric utilities, natural gas and telecommunications. Governments have recognized the need to ensure access to essential infrastructure in all sectors of the economy. While there is no universally accepted definition of essential, one review of U.S. regulatory decisions[3] found that regulators tended to apply four criteria when defining essential facilities:

- The facility is controlled by a monopolist or a group of competitors with monopoly power.
- Duplicating the facility is not commercially viable.
- Denying access to the facility, or imposing restrictive terms of access, has a substantial adverse effect on competition.
- There is no valid business reason for denying access.

Based on these criteria, if a potential entrant to the market could provide its own parallel infrastructure at the same or lower cost, access would not be a problem and the infrastructure would not be considered essential. For most transportation infrastructure, however, these criteria apply and access is an issue. In the case of intercity bus terminals, new entrants denied reasonable access to an existing bus terminal can often make their own arrangements for passenger pick-up and delivery. In some locations, however, bus terminals may be essential infrastructure. The advantages of the location of the central bus terminal in a major city may be such that carriers denied access would be at a considerable competitive disadvantage.

Governments can attempt to regulate fair and equitable access, but may not be able to enforce it effectively. Transportation infrastructure owners who have an interest in preventing competition may be able to hamper new entrants with subtle impediments. The question then arises: is carrier ownership undesirable where transportation infrastructure is essential? Governments must weigh the risks of anti-competitive conduct against the gains that may result from allowing a single organization to provide both carrier and infrastructure services. Such gains could exist where there are efficiencies in making carrier and infrastructure investment decisions together, or in jointly managing infrastructure and carrier operations. This issue is particularly relevant to the current institutional arrangements for passenger rail services, which we discuss later in this chapter.

## PUBLIC-SECTOR PROVIDERS OF TRANSPORTATION INFRASTRUCTURE: THE OPTIONS

### A Government Department

In Canada, most public transportation infrastructure, including roads, air traffic control and most airports, is the direct responsibility of government departments. This has advantages in some circumstances. It allows a high degree of political direction, which may be desirable when government objectives vary and cannot be clearly articulated in advance. When close political direction is necessary, however, it is important to find ways to increase transparency and improve accountability in order to sustain our basic principles for pricing and investment decisions.

A government department is at a disadvantage when it operates infrastructure such as roads and airports. Hierarchical and bureaucratic decision making can be costly and slow, particularly when departments need to respond rapidly to changing economic circumstances (for example, in carrying out functions with large operational or commercial components). In addition, the nature of centralized budgeting means that when more spending is part of the appropriate response to circumstances, departments will not be able to provide the funds because of other political priorities, even if the users are willing to pay.

Some of the problems of government departments can be addressed by contracting out certain activities to private firms. At present, most provincial and territorial government departments contract for road construction, and many contract for road maintenance. The federal government contracts with private firms to operate some of its smaller airports.

A government department is likely to be the best choice as a provider of transportation infrastructure where the benefits of satisfying a need for close policy direction outweigh the costs of a less-efficient operating environment. A government department may also be preferred if financing the infrastructure requires taxation, which governments closely control.

### A Crown Corporation

Crown corporations have greater autonomy than government departments. They generally have boards of directors that help ensure that decision making occurs at arm's length from governments. Governments, however, may provide general direction through legislation that establishes the Crown corporation and may retain the power to give it directives on key issues.

Using Crown corporations can facilitate implementing and enforcing our principles, can promote financial transparency and can provide greater efficiency than is likely with a government department. Efficiency may increase because of the advantages of decentralized decision making and the corporation's freedom from standardized departmental rules and bureaucratic procedures. The corporation may also put an increased emphasis on commercial objectives and internal incentives to promote improved commercial performance.

The advantages of a Crown corporation, however, may not be realized if governments fail to establish an adequate regime of accountability and control. Governments must include mechanisms for monitoring the corporation's performance to ensure that its board and management are fulfilling their responsibilities and not abusing market power. At the same time, we stress that monitoring and control must be oriented toward achieving general objectives and must not become a means by which governments micro manage Crown corporations. Where effective control can be exercised, a Crown corporation may be a better institutional choice for managing some transportation infrastructure. We caution against the politicization of Crown corporations by governments, which would detract from the usefulness of a Crown corporation for managing transportation infrastructure.

### An Independent Authority

An independent authority has greater autonomy than a Crown corporation. It generally has a board of directors composed of interested parties such as users, local or regional governments, professional associations, environmental group representatives and related interest groups. The board is not subject to government directives and has full authority for pricing and investment decisions, possibly subject to a regulatory review. One type of independent authority is the Local Airport Authority established to operate some federally owned airports. Similar independent authorities could be established to operate link and control components.

User-groups represented on the board of directors can directly influence levels and quality of service. Their influence also reduces the risk that fees will be set at monopolistic levels. We note, however, that an independent authority may make decisions contrary to the wishes of groups under-represented or not represented on its board. Such groups may include carriers who desire access to a particular facility. Since government does not monitor an independent authority's performance as it does a Crown corporation's, we believe it is extremely important that the independent authority's board membership adequately represent all interested parties. This would ensure that sufficient pressure could be generated within the organization for efficient performance.

An independent authority is a good choice for providing transportation infrastructure where there would be considerable gain from limiting government influence, and where interested parties could be adequately represented on the board. These factors were influential in the creation of Local Airport Authorities, which we discuss later in this chapter.

### Choosing the Appropriate Public-Sector Institution

There is no ideal institutional structure that should be used for all types of transportation infrastructure. The appropriateness of the organization will differ depending on the mode of transportation and the type of infrastructure. The choice also depends on the nature of government objectives and the inefficiencies that may result when government is involved in activities that require frequent decisions on operational issues.

In addition, the adequacy of an institution depends not just on its type — government department, Crown corporation or independent authority — but also on the mechanisms available to promote transparency and to increase the accountability of those making decisions. We believe, however, that there are advantages in moving away from governments' current reliance on their own departments for providing transportation infrastructure. Later in this chapter, we examine the type of institution that best matches certain modes and types of infrastructure.

## PUBLIC-SECTOR PROVIDERS OF TRANSPORTATION INFRASTRUCTURE: RELATED ISSUES

### Earmarking Revenues, Borrowing, and Controlling Charges

In Chapters 4 and 5, we stated that charges for the use of infrastructure should cover the full, efficient costs of operating the infrastructure.

This in turn suggests that the revenues raised from such charges be earmarked to cover the costs of such infrastructure. Costs should include payment to governments for a return on their investment in infrastructure. As well, owners of infrastructure might need to borrow in order to finance new construction (particularly in the case of an expanding operation). The interest and principal costs of borrowing should be paid for from revenues from charges to travellers.

Earmarking revenues and undertaking project-related borrowing are natural activities of Crown corporations and independent authorities. Although such activities are not as characteristic of government departments, departmental operations in the past have made some use of earmarked funds. These include revolving funds, a limited number of earmarked taxes such as the Air Transportation Tax, and social insurance charges such as the Unemployment Insurance premium.

Many Canadians will view charges to travellers as similar to taxes, particularly when such charges are not closely related to the benefits received and where the monopoly is powerful — as in the case of providing roads. In cases such as this, government may wish to maintain direct control over pricing. If government does not maintain direct control, then an independent regulatory body would be required to review charges proposed by the road owner.

### Advisory Arrangements

Advisory bodies may be useful supplements to any type of institution, but may be especially appropriate where a government department provides transportation infrastructure. Advisory bodies offer an independent source of counsel on pricing and investment decisions, and/or provide the public with independent information on the management of the infrastructure. Advisory groups have no power to make decisions and are not sufficient if the main goal is to separate decision making from the political process. An advisory body, however, may be a realistic first step toward institutional change when issues involve policies over which governments have closely guarded their authority.

An independent source of advice can also be beneficial for public agencies or independent authorities. It can provide some balance to the natural tendency on the part of management to empire-build — to increase their scope of activities wherever possible. In addition, advisory bodies that report publicly can make an important contribution to improving the transparency of financial arrangements and decision making.

## AIRPORTS

In Canada, the federal government currently owns the major national and regional airports as well as a number of the airports used by commercial air services in small communities and remote regions. Some of the major airports are now being transferred to Local Airport Authorities.

Federally owned airports operate under various types of management. Some, including the larger airports, are being managed directly by the federal Department of Transport or by Local Airport Authorities. Some are operated by private firms under contract. Others are leased out to regions or municipalities, with or without federal subsidies. Terminal 3 at Lester B. Pearson International Airport in Toronto is unique. It was developed and financed, and is being operated, by a private firm under a long-term lease agreement with the federal government.

As well, there are municipally owned airports such as Edmonton Municipal (one of the ten busiest airports in Canada) and privately owned airports such as Buttonville in Toronto.

Many other countries do not use government departments to operate major airports. Institutional arrangements vary:

- In the United States, major airports are run by municipal or county governments, or by airport or port authorities.[4]

- In the United Kingdom, seven major airports — Heathrow, Gatwick, Stansted, Prestwick, Glasgow, Edinburgh and Aberdeen — are now owned and operated by a private sector company (BAA plc). Smaller U.K. airports are owned by local city councils, private firms or, as in Liverpool, by both.
- In Germany, the 11 main airports are operated by independent companies, with the federal government as a minority shareholder in each airport corporation.
- Australia has a centralized institutional structure, but since 1986 the major airports have been managed by the Federal Airports Corporation, a Crown corporation with a commercial mandate.

## LOCAL AIRPORT AUTHORITIES (LAAs)

In Canada, the federal government is reducing its role in airport operations by transferring the operation of several major airports to Local Airport Authorities. Its objectives in so doing are "to make airports serve local community interests better and to allow our national airport system to operate in a more cost-efficient and commercial manner."[5] Currently, federally owned airports in Vancouver, Calgary, Edmonton and Montreal have been or are being transferred to LAAs, and several other large federal airports are expected to be considered for transfer.

### The Role of LAAs

LAAs are independent bodies that can enter into contracts, issue debentures, sue and be sued. Unlike private corporations, LAAs do not have shareholders. The Board of Directors runs the LAA and has responsibility for establishing objectives and policies, approving plans and budgets, and overseeing the performance of management. The enabling legislation or articles of incorporation for an LAA specify which governments and organizations may appoint board members. The nomination of elected government officials or government employees is prohibited.

The federal government has a continuing responsibility for air navigation and safety at LAA airports, and remains a landlord, leasing airports to the LAA on a long-term basis. The LAA operates the airport and assumes full responsibility for any financial liabilities it incurs. LAAs are expected to achieve financial viability by setting their own rates and developing the commercial potential of the airport. LAAs have 60-year leases with a rental formula that allows the federal government to share in any growth in gross revenue above a base-case forecast. Under this formula, the federal government should be no worse off financially, and potentially better off, than it would have been had it continued to operate the airport.

## Potential Monopoly Power of LAAs and Other Major Airports

Federal policy concerning LAAs does not include any explicit provision to control monopoly power. We believe that it is important to look at the potential for non-competitive pricing of landing rights by local authorities.

The potential for non-competitive pricing is enhanced by the fact that landing fees generally constitute a small portion of flight costs; this tends to cause carrier demand for landing rights to be relatively unresponsive to increases in landing fees. The market power of the LAAs also depends on the opportunity for carriers and other users to switch to another airport. For example, if Airport B is a close substitute for Airport A, any attempt by A to unilaterally raise its landing fees would have a detrimental effect on its traffic. In practice, however, the ability of airlines in Canada to use alternative airports is limited. For non-connecting traffic, which constitutes around 70 percent of the traffic at most Canadian airports, airlines have an alternative only when a second relatively uncongested airport is in close proximity. Few Canadian centres have two or more airports that are in a position to compete with each other for such traffic. The result is that, in general, airlines have few opportunities to switch airports if LAAs abuse their market power by setting excessively high landing fees.

The possibility that carrier access could be restricted at airports under LAA control also warrants examination. Transport Canada officials argue that the interest of the local community is in promoting access by as many carriers flying to as many locations as possible. An LAA might, however, find that, in principle, it could maximize its own revenue by awarding a long-term exclusive lease to a single carrier who would be willing to pay a price for the exclusive lease, which would allow it to earn monopoly profits. This arrangement would limit local residents' choice of airlines. Under these circumstances, the onus would be on the Director of Investigation and Research in the federal Department of Consumer and Corporate Affairs to enforce the prohibitions in Canada's *Competition Act* against exclusive contracts and discrimination in supply.

We believe that the nature of LAA boards and the *Competition Act* provide considerable protection against monopoly pricing and, in particular, limitation of access to competing carriers. At this stage, we do not recommend establishing a referee with review powers over LAA pricing. LAA pricing, however, should be monitored by the National Transportation Agency on behalf of the federal government.

## THE IMPACT OF FEDERAL POLICIES ON COSTS

Federal control may increase operating costs at Canadian airports because of:

- delays in making new investments where expansion is justified;
- administrative overhead;
- operating standards that are inappropriate for and that substantially increase costs at smaller federal airports; and
- inflexibilities associated with federal labour practices.

The problem of inappropriate common standards is illustrated by the government policy of having separate Emergency Response Services (ERS) available on-site at even the smallest federally operated airport with scheduled commercial flights. For example, at Yarmouth, Nova Scotia (a federally operated airport), approximately one fifth of operating expenditures are associated with maintaining on-site ERS. By comparison, Oshawa, Ontario (a non-federally operated airport with similar traffic levels) relies on the local fire department and incurs no ERS expenses. Oshawa's total operating expenses are about one-quarter Yarmouth's. The higher ERS costs at Yarmouth are not due to poorer performance by airport staff, but to costs associated with federal airport policy.[6]

The impact of federal work rules was illustrated in a 1985 report by the Auditor General of Canada that compared airport maintenance at three U.S. airports with that of three similar Canadian, federally operated airports. The report found that labour requirements at the U.S. airports were 40 percent lower. While employees at U.S. airports performed a variety of functions, Canadian workers were hired for specific maintenance functions. The result was lower labour productivity and higher operating costs.[7]

## GUIDELINES FOR AIRPORT REFORM

Investment in federal airports has been influenced by the federal government's financial position. We believe it is important for the airports to be self-financing in all aspects, including air traffic control.

Local control of federal airports will alleviate some of the problems of the current system. Decentralized decision making will allow airport management to pay greater attention to the preferences of residents of the region served by the airport, who are also the primary users of the airport and bear the consequences and reap the benefits of new airport development. Decentralized decision making should also contribute to greater transparency. Users can see more clearly what they are paying for in a system where there is a direct connection between charges to travellers and capital spending.

Therefore, we **recommend** that:

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**6.1 The federal government proceed quickly with the transfer of all remaining federal airports to local airport authorities and/or to other types of local operators.**

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## AIR NAVIGATION

Canada's air navigation system has been under increasing pressure from the growth in air traffic following deregulation of the airline industry and increased activity at certain hub airports. In our hearings, speakers expressed concern that air traffic operations are underfunded and, therefore, cannot adequately respond to market demands. In July 1991, the Air Transport Association of Canada, the Canadian Airline Pilots Association, the Canadian Air Traffic Controllers Association and the Canadian Business Aircraft Association observed, in a letter to the federal Minister and Deputy Minister of Transport, that "the present Air Traffic Control System is not serving the interests of the travelling public, pilots nor the aviation industry and is creating a progressively higher level of frustration in employees working the system who wish to perform a professional service."

The federal government has responded. In particular, Transport Canada is looking at ways to increase the number of licensed air traffic controllers, and has developed a comprehensive plan to meet requirements for controllers by July 1994.

We believe, however, that these issues reflect fundamental deficiencies in Canada's current organizational arrangements for air navigation. Stress on the system would be reduced in an environment where managers had greater operational freedom and access to revenue that allowed them to respond to changing requirements. The 1991 final report of the Ministerial Task Force on Aviation Matters expressed the issue thus: "The public service environment with its restraints, slow and complicated processes, uncertainty of funding within the government's competing demands and lengthy decision-making processes seemingly inherent in a civil service does not correspond to the dynamic environment in which aviation operates. All of these factors combine to limit the flexibility of the department and reduce its ability to respond quickly and effectively to the ever-growing demands of the aviation community."[8]

In the United States, the Federal Aviation Administration (FAA) has somewhat greater operational freedom than its Canadian counterpart, although it is still part of the U.S. Department of Transportation. A number of other countries — Australia, New Zealand, the United Kingdom and Germany — are establishing their air navigation systems with independent status. The Ministerial Task Force on Aviation Matters also favours this general approach.

We therefore **recommend** that:

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**6.2 The federal government convert the air navigation system from a departmental organization to either a Crown corporation or an independent institution.**

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An independent institution, separate from government, is consistent with, and complementary to, our proposal in Chapter 5 that airline companies pay the full costs of air navigation. Such an organization might be a publicly owned independent authority or a private corporation owned jointly by airline companies. A user-funded institution free from the restrictions that apply to government departments would be in a better position to meet the requirements of the airline industry.

## THE ROLE OF THE FEDERAL GOVERNMENT

Under our proposal, Transport Canada would continue to ensure that the air navigation system meets appropriate safety standards. The federal government must also be in a position to ensure that international obligations to provide access to foreign carriers, and to comply with international technical standards, are met.

In addition, if air navigation is assigned to a Crown corporation, the federal government would be responsible for monitoring activities and reviewing performance, as it does with all federal corporations subject to the *Financial Administration Act*. Since the proposed agency would be a monopoly, albeit a public monopoly, one of the purposes of federal review would be to ensure that the agency did not abuse its monopoly powers.

## AN INDEPENDENT INSTITUTION

An alternative to a Crown corporation would be a private corporation, jointly owned by the users, with the federal government still responsible for regulating safety. Since such a corporation would be responsible to its owners, who are also users, it would be less likely to exploit its monopoly position. Its owners and users would want the highest level of service at the lowest possible cost.

We see advantages in a privately owned, user-operated air navigation system that is subject to government safety regulation. Before such a system could be implemented, however, the federal government must ensure that the interests of all stakeholders are adequately represented. For example, those with a minor, or no, position in the corporation (such as small carriers or general aviation) must not be discriminated against. The system must also be set up in a way that precludes it from being able to put potential new entrants to the airline industry at a disadvantage. If the independent institution's charter does not give adequate representation to all these interests, the federal government should appoint a referee. If the federal government is unable to establish a private corporation that gives adequate protection to all interested parties, a Crown corporation would be preferable to an independent institution.

## ROADS

Highway networks are unlikely to be privatized or turned over fully to independent authorities in the near future. A major role for Crown corporations with a considerable degree of independence holds more immediate promise. Governments have traditionally retained close control over the extent and location of roads and the charges for their use. Road pricing will probably continue to take the form of fuel charges and licence fees, supplemented by weight-distance charges on trucks. All of these charges are generally uniform within a province.

With uniform charges, prices and revenues provide limited guidance in assessing specific road investment decisions. Toll roads are the exception. Pricing can then be specific to individual links, and prices and revenues can provide a basis for investment decisions.

While governments are likely to retain responsibility for decision making, they should be more accountable and the nature and implications of decisions should be more transparent. Road users should have information that will enable them to assess whether the highway system is being efficiently managed through appropriate decisions on investments and maintenance.

### TRANSIT NEW ZEALAND: A MODEL

In 1989, the New Zealand government created Transit New Zealand, an institution established outside the departmental structure in order to remove political influence from expenditure decisions. Transit New Zealand coordinates road planning and provides independent advice on road revenue policy and road expenditures. Although the Minister of Transport must approve its annual revenue and expenditure proposals, these proposals carry considerable weight as a result of Transit New Zealand's extensive system of consultation and highly transparent system of road planning.

Transit New Zealand develops an annual National Land Transport Programme, drawing on plans developed in each of the 14 regions of New Zealand. These plans are based on decisions made at the local level. The Land Transport Fund, managed by Transit New Zealand, finances expenditures and provides all participants in the system with a clear picture of revenues and expenditures.[9] Revenues come from fuel taxes, other charges to road users (including a weight-distance charge for heavier trucks), and motor-vehicle registration and licensing fees.

## GUIDELINES FOR PROVINCIAL AND TERRITORIAL ROAD AGENCIES

New Zealand's approach shows how a Crown corporation can be used to encourage greater efficiency, and to increase accountability and transparency in pricing and investment decisions.

We therefore **recommend** that:

**6.3 Each provincial and territorial government establish a Crown corporation, supplemented by an advisory group, to provide roads more efficiently and to make road pricing and investment decisions more transparent.**

The advisory bodies should include specific user-groups as well as other groups that have system-wide interests, such as those concerned with the environment. The mandate of the advisory body should be broad enough to include links between the roads and other modes of transport.

We expect that most provincial or territorial governments would wish to retain final authority over levels of fuel tax, motor-vehicle licence fees and weight-distance charges. But we suggest that provincial and territorial governments make decisions on these charges in response to proposals from their road agencies, which would recommend levels for the charges together with road investment plans.

Under our principles, revenues from charges to travellers transferred to a road agency should be related to use of the roads for which the agency is responsible. For example, if a road agency is responsible for building and maintaining provincial but not municipal roads, revenues related to the use of municipal roads should be handled separately.

The provincial government would allocate, as accurately as possible, the portion of total fuel-tax revenues in a province to a "road account." It should also consider applying a fuel tax to cover road-related policing costs, traffic control and some health system costs (Chapter 8). In addition, the provincial or territorial government may be the appropriate level of government to apply some environmental charges (Chapter 7).

## THE NATIONAL HIGHWAY SYSTEM PROPOSAL

The Federal-Provincial Council of Ministers Responsible for Transportation and Highway Safety is currently studying a National Highway Policy proposal. The proposal would designate, as the National Highway System (NHS), a network of highways linking provincial and territorial capital cities, other main population centres, major ports and U.S. border crossings. The network would be almost 25,000 kilometres in length, compared with 7,300 kilometres for the Trans-Canada Highway.

The proposal suggests that the network be upgraded "to bring cohesiveness, prestige and uniformity of standards to the major highway transportation linkages of national significance in Canada."[10] Minimum standards would include:

- a design speed of 100 kilometres per hour — that is, highway alignment and shoulders sufficient to allow 100 kilometres per hour operating speed;
- sufficient capacity to handle the volume of traffic expected without average speed falling below 90 kilometres per hour;
- bridge and road strength adequate to handle traffic without seasonal weight restrictions; and
- road surfaces to meet a consistent measure of ride smoothness.

According to studies performed for the Council of Ministers Responsible for Transportation and Highway Safety, many existing highways that would form part of the intended network do not meet these standards. They found that:

- about one third of its length does not meet the proposed minimum standard for 100 kilometres per hour design speed because of inadequate width, alignment, or shoulders;
- about 19 percent of the network is at times too congested to allow 90 kilometres per hour continuous operation;
- almost 16 percent of the network has load restrictions and requires pavement or bridge reconstruction to handle the maximum loads allowed under national standards; and
- about 16 percent of the network needs resurfacing to meet the proposed standard for ride smoothness.

In total, about 9,500 kilometres of the proposed 25,000-kilometre network would not meet one or more of the proposed minimum standards, and 790 bridges would need strengthening.

### The Costs of Upgrading the NHS Network

The National Highway Policy proposal has identified all of the upgrades that would be required to meet these standards — some

2,000 separate projects with a total estimated cost of $12.7 billion in 1989 prices. A secondary proposal under consideration would add the twinning of all remaining sections of the Trans-Canada Highway for an additional cost of $4.8 billion in 1989 prices.

The Council of Ministers Responsible for Transportation and Highway Safety is examining whether the federal, provincial and territorial governments can reach a cost-sharing agreement to allow adoption of these proposals.

### Assessing the NHS Proposal Using Our Principles

We believe that governments should assess the NHS proposal using our principles for investment decisions, and provide financial support for component projects only if the benefits exceed the costs and if the project can be paid for by the travellers who use it. Governments should also compare these projects with possible investments in other modes and other locations. Approved NHS projects should then be financed by charges to road users.

An analysis of the NHS showed that the proposal as a whole would not meet the benefit-cost test.[11] Using Transport Canada's standard valuations of benefits, it appears that the costs of upgrading the network to the proposed uniform standards exceed expected benefits, and that the additional proposal to twin the remainder of the Trans-Canada Highway would increase the net loss substantially.

Some of the projects, however, could produce substantial net benefits over their costs. For example, many of the maintenance projects for existing roads, such as bridge rehabilitation and highway resurfacing, are more beneficial than many proposed investments in building new lanes or widening existing highways. In addition, the proposed improvements most easily meet the benefit-cost test for the more intensively used parts of the network, (generally located in more populated regions of the country).

We believe that, rather than trying to make a decision on the proposal as a whole, projects should be rigorously evaluated on an individual basis. Governments should establish priorities for those projects that pass a benefit-cost test. We see the National Highway Policy proposal as an example of the potential for excessive spending that can arise when common national standards and engineering conventions are emphasized, but little attention is given to assessing the economic benefits and costs of individual projects.

### Recommendations for the National Highway System

The proposed minimum standards would require a substantial expansion of capacity for many low-volume roads. The failure of many of the proposed projects to meet a benefit-cost test, however, demonstrates that the proposed engineering standards are not appropriate to all highways and traffic conditions. On those parts of the network with less traffic, some more-modest upgrading projects, to meet standards of capacity and performance somewhat less rigorous than those applied to roads with higher volumes of traffic, might be sufficient. To achieve efficiency, governments should tailor solutions to local conditions.

Therefore, we **recommend** that:

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**6.4 The extent of restoration and upgrading of the national highway network be guided by comparison of benefits and costs on individual projects, rather than by uniform engineering standards.**

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Our rejection of the minimum engineering design standards in the NHS proposal does not mean that the entire proposal should be abandoned. We believe there are advantages to be gained from designating a National Highway System and giving it maintenance priority, special markings and uniform signs. Both carriers and travellers would gain from using a system of interconnected roads of predictable quality.

We believe the proposed network is viable because it could generate sufficient revenue from users to pay for maintenance and upgrading. We do not believe, however, that all of the upgrading in the current proposal is necessary. Outside the most populated areas, there is substantial excess capacity in Canada's highway system. It would not make sense to increase that capacity still further to meet arbitrarily set minimum engineering standards. Upgrading should concentrate on the existing and potential problem areas.

The National Highway System could be operated by a Crown corporation, raising its funds through charges to travellers using the designated network or receiving appropriate transfers of the fuel taxes and registration fees from governments. Such an agency could provide users with a clear picture of road costs and provide a mechanism for formal consultations. We believe, however, that the key improvements in this highway network could be achieved by simpler forms of coordination on the part of provincial and territorial governments and/or their road agencies.

Therefore, we **recommend** that:

**6.5 A National Highway System (NHS) be identified by the Council of Ministers Responsible for Transportation and Highway Safety, and the system be operated and maintained through cooperative action of provincial and territorial governments and/or their road agencies.**

We also believe that the rationale is weak for funding projects through a national charge to all travellers or federal-provincial cost-sharing. The projects on the proposed network that meet a benefit-cost test are concentrated in Central Canada, where the population is densest, rather than spread equally across the country. The funding of such projects should be the responsibility of travellers in those regions that benefit from these investments.

Therefore, we **recommend** that:

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**6.6 Provincial and territorial governments meet the costs of their highway system, and any agreed upon National Highway System projects within their borders, through fuel taxes and other charges.**

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Under our principles, the federal government would no longer raise revenues from fuel taxes, except as an environmental charge on fuels (Recommendation 5.4).

We expect that examining the benefits and costs of all road projects will indicate that most worthwhile NHS projects can be financed by provincial or territorial governments using monies that might have been spent on other, lower-priority road projects.

## CONTROL OF RAIL TRACKS, STATIONS AND TRAINS

Rail is different from other modes of transportation because individual carriers often own the rights-of-way, track, and train-movement control systems. We are concerned about two rail issues:

- how ownership of the track influences competition to provide rail passenger and freight services; and
- how the need for rationalization of track networks can be met. Such rationalization raises the issue of rights-of-way abandonment, which we highlighted in our Interim Report.

### OWNERSHIP AND COMPETITION ISSUES

Is open access compromised when rail carriers own essential transportation infrastructure? Under our principles, open access to essential facilities is intended to promote competition. While we realize that it will often be impractical in all cases to provide competing rail infrastructure, we believe that considerable benefits of competition may still be obtained by allowing more than one carrier to use the existing track.

A freight or passenger carrier that owns track may create an entry barrier to new rail carriers and may impede the operations of competitive carriers. A new carrier can only enter passenger rail or freight carriage if it can negotiate reasonable terms of access with a track owner who may also be a competitor. Rail carriers thus tend not to be subject to the discipline that, in other modes, comes from the threat of entry.

Direct competition is less likely to occur in passenger rail than in freight carriage because unsubsidized passenger service has not been profitable. We are still concerned, however, that there be sufficient access for new carriers in passenger rail should they wish to enter the markets. Convenient entry for a carrier would ensure that passenger rail is given the opportunity to demonstrate its strengths in instances where it has a chance of being viable.

Passenger rail can be complementary to freight, because both services share the cost of the track. It can, however, compete with freight on heavily used segments of the track where the two users have conflicting requirements. This conflict accounts for some of VIA Rail's difficulties in obtaining optimal track access. As well, the federal government requires VIA Rail to service certain markets, putting VIA Rail in a weak bargaining position. It cannot refuse to deal with CN or CP simply because their services or rates for track usage are unacceptable.

## IMPROVING ACCESS TO RAIL TRACKS

Steps can be taken to improve access to rail tracks for new entrants and others willing to pay their share of the costs, by:

- establishing stronger legislative provisions and regulatory procedures to promote access; and

- if such legislation proves insufficient, separating ownership of track and carrier operations by restructuring CN and CP.

Separation could be achieved by creating a public or a private track corporation that would own and manage the national track network.

### Improving Access through Legislation and Regulation

Running rights, the rights that allow one railway company to operate over the tracks of another company, have a long history in Canada. Legislation on running rights from the earlier *Railway Act* was incorporated into the *National Transportation Act, 1987*. Under this Act, the National Transportation Agency can order one railway company to provide running rights to another if the two railway companies cannot work out an agreement on their own, and if the Agency deems access to be in the public interest. This provision, however, is contained in a section of the NTA, 1987, that applies exclusively to rail freight.

Therefore, we **recommend** that:

**6.7 Legislation on track access also apply to passenger rail, so that all qualified carriers willing to pay for what they use have a right of access to essential rail infrastructure and to equal treatment in movement of rail traffic.**

Unless the owner can prove that running rights would create unresolvable operational problems in a particular situation, the legislation should require the National Transportation Agency to agree to an application for access by all carriers that are "fit, willing and able" to use the infrastructure.

The technological, dispatch and traffic control issues associated with opening the track to multiple users are not a problem unless the owner of the track also happens to be a user in competition with other users of that same track. As for other modes, especially air, sophisticated techniques of traffic control are available. In addition, the rail industry has had considerable experience with trackage rights and joint agreements that raise many of the same issues. In negotiating these arrangements, railway companies have had to work out operating rules, establish track priorities and apportion liability. We see little evidence that the resolution of these issues has resulted in operational problems.

Improved legislation, however, may not be sufficient to solve certain problems of access. For example, a railway company could allow other carriers access to its tracks but establish rates or conditions that would make use of the track highly unattractive. A host railway can also substantially disadvantage a potential competitor through its traffic control and dispatch operations.

While the National Transportation Agency can attempt to guard against such anti-competitive practices, a track owner could abuse its monopoly position in subtle ways. In addition, it is difficult for a regulator to determine a reasonable track charge that is fair to the owner but does not disadvantage the user.

A number of countries require their state-owned railways to develop separate accounts that identify the costs of the track and control components of their operations. The Council of the European Communities is asking member states "to ensure that the accounts for business relating to the provision of transport services and those relating to the management of railway infrastructure are kept separate. . . ."[12] The Council believes this separation will promote fair charges to travellers and facilitate cross-border movement by the carriers of member countries.

Appropriate legislation, combined with adequate enforcement of regulations, provides the most direct solution to problems of access.

By strengthening and broadening existing provisions on running rights, the federal government would be building on an approach that is well understood by the railways and the National Transportation Agency. Nevertheless, we are not entirely convinced that legislation and regulation will prove adequate. Where a railway has an interest in restricting access, the regulatory authority might find it difficult to ensure that the new entrant is provided with a neutral opportunity, including fair treatment by the dispatch system.[13] We expect that the track owner will have more information than the regulator, and the regulator will be at a disadvantage in attempting to enforce equal access.

### Improving Access by Separating Ownership of Track and Carrier Operations

We considered the possibility of restructuring CN and CP to divide ownership of track and carrier operations (as in the road and air modes). Such a separation has its precedents:

- The earliest railways in the United States operated fixed ways that others paid to use, as did the other transportation modes of the era (turnpikes and canals).
- In 1989, the Swedish government split its state railway into two separate organizations: a public enterprise that is responsible for offering railway transportation services, and a second public agency, the National Rail Administration that is responsible for providing rail track and control systems. Sweden's restructuring was intended to put rail on a basis more comparable with the road mode, and the National Rail Administration is modelled on that country's National Road Administration. The Swedish government believes that separating track ownership from commercial carrier services, and the greater transparency resulting from the new arrangement, will increase pressure on the national rail carrier to improve operating efficiency. The government also hopes that, over the long term, new rail carriers will enter the market and consumers will benefit from the introduction of competition.

A system of separate ownership would result in the loss of savings, if any, associated with the joint provision of rail track and carrier operations. Government would have to decide whether such savings are important enough to offset the benefits from enhanced competition. The available evidence, while limited, does not suggest that there are major economies when carriers own railway track.

While we believe it is feasible to establish a separate track corporation, a structural reform of this nature is a major undertaking. Sweden's experience is not entirely applicable to Canada, because Canadian track is owned by a number of public and private corporations, rather than just one public corporation. Rail restructuring is much less complicated when there is a single public carrier, and when the national government has the authority to implement the reorganization required to improve use of the track.

If the Government of Canada were to undertake such an initiative, and if it felt the infrastructure should be publicly owned, it would have to acquire track that it does not already own. This process could entail difficult negotiations with owners over compensation. Both CN and CP would be primarily freight carriers with neither owning railway track. At that point, CN should be privatized to create fair competition for CP, and the proceeds of the sale would help pay for the purchase of the CP infrastructure.

Determining appropriate charges for track use would also be difficult. CN and CP own extensive track in the United States. Track fees and charges at a level required to cover the costs of a track corporation might result in CN and CP diverting traffic to alternative U.S. routes. This diversion could be greater on some network segments (primarily traffic to and from the west) than on others (traffic that moves within Ontario, Quebec and the Maritimes).

### Should a Separate Rail Track Agency be Public or Private?

If experience with enhanced track access is unsatisfactory and the federal government determines that separation of rail ownership and carrier operations should be implemented, the government would have to decide if track ownership would be best transferred to a Crown corporation or a private corporation. Whether public or private, the new organization must be regulated in such a way that it could not abuse its monopoly position.

In the case of a private corporation, the federal government would have to put together a package that appealed to private investors and could attract the large amount of financial capital required. The federal government would otherwise have to make certain commitments to reduce the risks from unanticipated policy change that the corporation would otherwise face. With a Crown corporation, the federal government would not have to limit its freedom in this way. In addition, the federal government's extensive holdings of track and rights-of-way through CN and VIA Rail could be transferred to the public track agency and provide the assets required to launch its operations. We thus conclude that, should separation be favoured, a public track agency is likely to prove appropriate.

In Canada, separating ownership of rail track and carrier operations is more important as a freight issue than as a passenger issue, because freight traffic dominates Canadian rail activity. Freight transportation is not the focus of our mandate, and we have not attempted to investigate, or explore with the various parties involved, the full range of questions that must be answered before a decision on separation can be made. Nevertheless, we view effective open access and equal treatment of traffic as vital. Should the application of Recommendation 6.7 — that legislation on track access be strengthened and apply to passenger rail as well as freight — not prove satisfactory, then we would recommend that the federal government separate ownership of track and dispatch from carrier operations.

If the federal government decides that separation is necessary, the best approach may be a step-by-step introduction of change. The process could begin with a segment of the network that would be a good choice for rail rationalization. For example, a public track agency could be established with responsibility for CN's and VIA Rail's rights-of-way and track in the Toronto–Ottawa–Montreal triangle. At the same time, the federal government could negotiate with CP so that the authority of the new agency could extend to all track in the region. The intention would be to rationalize track use in that region.

This first step would allow the federal government to test separation, and at the same time initiate rationalization of track use in the Toronto–Ottawa–Montreal triangle. If this experience shows that separation is beneficial, the scope of the track agency's operations could be extended to include the rail network running through Quebec and the Maritimes, where rationalization also seems warranted. The federal government could then consider a final phase of reform involving transferring track in the rest of the country to the track agency.

## RAIL RATIONALIZATION

Rationalization is not a new issue. As far back as 1931, the Royal Commission on Railways and Transportation in Canada found significant duplications among CN and CP railway systems. The Commission noted that there were twice as many miles of track per capita in Canada as in the United States, and that changing markets, competition and technology had decreased the need for railway infrastructure.

Canada's railways still suffer from low traffic density. On all but a few routes, Canadian railways could handle many more trains on their tracks. There are two ways to improve the financial position of the railways: increase traffic and operations and rationalize the track system.

With respect to increasing traffic, we expect that when governments apply our recommendations concerning road pricing, the competitive position of the railways will improve. Some freight that now moves by truck would shift to rail.

Rationalization and joint track usage have been the subject of sporadic, unsuccessful negotiation between CN and CP for many decades. The *Canadian National–Canadian Pacific Act, 1933*, that followed the 1931 Royal Commission, encouraged cooperation between the railways, including joint track usage. The NTA, 1987, included provision for joint track usage, but has not stimulated significant rationalization.

Rationalizing the track system could be approached in three non-exclusive ways that could vary from region to region. These are:

- line abandonment and joint track usage;
- divestiture of the local branch-line systems of each or both companies, and their reorganization as local short-line companies; and
- consolidation of CN's and CP's freight operations, either regionally or nationally.

### Line Abandonment and Joint Track Usage

The distinction between line abandonment and disposition of rights-of-way should be clear. We have no quarrel with the right of a railway to abandon part or all of a line. Our concern is what happens to that corridor after it has been abandoned as a functioning line; in the past, too many corridors have been sold for commercial purposes or for usage other than transportation. We firmly believe that these should be conserved for future transportation use, for example in the form of linear parks, and that governments or other railways should have first call when corridors are abandoned.

To what extent might abandonment improve the financial positions of the railways? In terms of branch lines, abandoning the lines in the prairie network that compete with road to serve the grain industry alone would generate important savings. A recent estimate suggests that abandoning selected prairie lines could result in annual savings of about $25 million.[14] For the rest of the networks, the prospects for saving through abandoning local branch lines, as opposed to abandoning whole regional systems such as in the Maritimes, are limited to a few million dollars annually.

Joint usage of main lines would boost efficiency and savings for the railways more than abandoning low-density branch lines. Closing branch lines causes traffic to shift from rail to road, but main lines could be rationalized with little loss of traffic. A more efficient railway track system might actually lead to an increase in the use of railway transport.

Substantial savings would occur if rationalization took place on the track that stretches from Winnipeg to the Ottawa Valley. For a capital investment of approximately $100 million, CN and CP could operate through this region over common track, saving 2,200 kilometres of mostly main-line track and eventually realizing savings of $50 million annually.[15]

We believe that this rationalization is desirable. We noted in our Interim Report, however, that line abandonment could lead to the loss of transportation corridors for future use.[16] Potentially important corridors in and near urban areas have already been lost through abandonment and cannot be replaced.

The *National Transportation Act, 1987*, contains a provision, which expires in 1993, whereby railway companies can apply to the National Transportation Agency to abandon up to 4 percent of their non-grain-related trackage annually. The Agency must agree to an abandonment application if the rail line is not economically viable and has no reasonable probability of becoming so in the future. As we noted in our Interim Report, under the NTA, 1987, the Agency determines the role and value of rail infrastructure in terms of its contribution to the movement of freight.[17]

The abandonment application procedures have recently been amended. A railway applying to abandon operation of a line must formally notify, among others, the federal and relevant provincial and municipal governments, other railways operating nearby and VIA Rail.

The legislated process does not provide for the long-term implications of the loss of track for passenger service or for rights-of-way for future transportation use.

We want to ensure that there are formal procedures for the disposal of rights-of-way after a rail line has been abandoned, and that this process gives governments an opportunity to acquire the rights-of-way if appropriate. Although railway officials told us that they offer abandoned rights-of-way to successive levels of government, the process is informal and inconsistent. In addition, the railways do not always put abandoned rights-of-way in urban areas up for sale. Instead, they retain and develop the lands commercially themselves. It is these urban rights-of-way that cause us the most concern.

We conclude from our review of line abandonment that:

- there should be formal procedures, regularly followed, by which all abandoned rights-of-way are offered to governments;
- governments should have established policies by which they are able to identify, acquire and retain rights-of-way that may be valuable for future use; and
- there should be rules to ensure that the price to governments of acquiring identified rights-of-way is reasonable, considering the historical use of the land as a corridor.

We believe that railways should be allowed to cease unprofitable activities, but rights-of-way that may be useful to others must be preserved.

Transport Canada has brought the concerns that were raised in our Interim Report to the attention of a federal-provincial steering committee that has been asked by the federal and provincial/territorial ministers of transport to identify a national rail network. The mandate of this committee includes reviewing policies and procedures to address concerns with rail line abandonment. Transport Canada has also indicated that it hopes to put in place an interim notice and response process and to develop long-term policy options. Although it is too early to say what the outcome of all this work will be, we believe that changes are required.

Therefore, we **recommend** that:

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**6.8 Any railway company be allowed to abandon any amount of track without a limit and that clause 159(4) of the *National Transportation Act, 1987* not be reenacted.**

We further **recommend** that:

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**6.9 Adequate protection of rights-of-way of potential value as future transportation corridors be assured by requiring that:**

**(a) as a condition of track abandonment, the abandoned right-of-way be offered in all cases, formally and in writing, to each level of government (federal, provincial, local), in succession, and then to other railway companies at a price equal, in all cases, to the railway's historical acquisition cost of the land adjusted for inflation, with an adequate time period for response;**

**(b) the National Transportation Agency be a referee to ensure that the price at which the land is offered is reasonable;**

**(c) only if no government or railway company wishes to purchase the corridor could the railway either convert or sell the land for purposes other than transportation;**

**(d) all levels of government develop a policy, based on explicit criteria, for deciding which corridors they wish to retain; and**

**(e) governments or railway companies maintain land so acquired as a corridor. Should they no longer wish to maintain the corridor in the future, the land be first offered back to the railway from which it was purchased, at the original purchase price plus inflation.**

# ENDNOTES

1. Jose A. Gomez-Ibanez and John R. Meyer, "Toll Roads and Private Concessions in France and Spain," Interim Report for the U.S. Department of Transportation, February 1992.

2. U.S. General Accounting Office, *Airline Competition*, GAO/RCED-90-147, August 1990.

3. William B. Tye, "Competitive Access: A Comparative Industry Approach to the Essential Facility Doctrine," *Energy Law Journal* 8, 2 (1987).

4. The distinction is that an airport authority is responsible only for an airport, while a port authority operates a variety of facilities (which may include airports, harbours, bridges and toll roads).

5. Statement by Transport Minister John Crosbie in announcing new policy, "New Management for Canadian Airports," Transport Canada Information No. 61/87, April 9, 1987.

6. Gordon B. Hamilton, "Cost Competitiveness of Canadian Airports," paper presented to ATAC 57th Annual General Meeting, Vancouver, Canada, November 10–12, 1991. Additional data provided by Transport Canada.

7. *Report of the Auditor General to the House of Commons, Fiscal Year Ended 31 March 1985* (Ottawa: Supply and Services Canada, 1985).

8. Transport Canada, Ministerial Task Force on Aviation Matters, *Final Report*, 1992, p. 21.

9. New Zealand Ministry of Transport, *Land Transport System*, 1990.

10. See Council of Ministers Responsible for Transportation and Highway Safety, National Highway Policy Steering Committee, *National Highway Policy Study for Canada, Steering Committee Report on Phase 3* (Ottawa: September 1990).

11. See ADI Limited, *National Highway Policy User Benefits Analysis Final Report*, prepared for National Highway Policy Study Committee, 2567-4, (Ottawa: November 1989); and ADI Limited, Analysis of National Highway System Proposals, a report prepared for the Royal Commission on National Passenger Transportation, RR-12, March 1992.

12. *Official Journal of the European Communities*, Council Directive of 29 July 1991 on the development of the Community's railways (91/440/EEC), Section III, Article 6.

13. Train movements on modern rail networks are coordinated centrally, usually through the signal system. The dispatcher decides which trains proceed towards their destinations, and which trains must wait on sidings.

14. T. Reynolds, "Projected Cost Reductions and Efficiencies through Abandonment of Selected Rail Segments," *Proceedings of the 27th Annual Meeting of The Canadian Transportation Research Forum*, Banff, Canada, June 9–12, 1992.

15. These are rough estimates by Royal Commission staff, based on potential reduction in track length and average annual track costs per kilometre. Initially, these savings would not be fully achieved. Employment security provisions in the contracts of senior shopcraft and maintenance-of-way employees would come into play until these employees were reabsorbed or reached retirement.

16. *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation*, (Ottawa: Supply and Services Canada, April 1991) pp. 208-209.

17. *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation*, (Ottawa: Supply and Services Canada, April 1991) p. 209.

# CHAPTER 7

# PROTECTING THE ENVIRONMENT

## INTRODUCTION

Passenger transportation affects the environment locally, nationally and globally. Noise pollution disturbs city residents and those living near airports; air pollution damages buildings and affects the health of people, animals and vegetation; and the greenhouse effect threatens the world's ecosystems.

One of the key objectives of our proposed passenger transportation framework is to achieve a system that automatically gives weight to the need to protect the environment. We believe that this can best be accomplished if users pay for the full costs of passenger transportation — including the environmental costs associated with different modes of travel.

At present, travellers and carriers do not pay for all the damage they cause to the environment. In fact, they cover only some of the costs of their transportation choices. Often, the decisions they make concerning how they will travel and which vehicle to purchase do not take into account the environmental repercussions of these choices. Meanwhile, others bear the costs of the damage done by travellers. As noted in Chapter 6, agencies that evaluate transportation investment proposals should consider the costs of environmental damage.

There are, however, many difficulties in trying to measure environmental damage, estimate costs and determine how users should be charged. We realize that protecting the environment may require more than charges to travellers. Regulations, particularly in the area of motor-vehicle emissions, have been instrumental in reducing gases and particulates that damage the environment.

We examined ways of assessing environmental damage and estimating costs. We asked ourselves how much governments should regulate and how much travellers should pay. Then we looked for solutions that would impose an even burden on each mode of travel and that would help Canadians achieve a balance between their passenger transportation needs and the need to protect the environment.

## HOW TRANSPORTATION CONTRIBUTES TO ENVIRONMENTAL DAMAGE

We studied environmental effects and conferred extensively with environmental experts. Much of the information we gathered, including how transportation contributes to environmental damage and the nature of that damage, can be found in Volume 2 of this report. In this chapter, we would like to focus attention on the three transportation-related environmental problems that we consider to be the most significant: low-level ozone, urban sprawl and global warming. Other significant transportation-related environmental problems, including those associated with carbon monoxide and particulates, receive very limited mention in this chapter because they are fundamentally problems of urban, rather than intercity, passenger transportation.

### LOW-LEVEL OZONE INDUCING EMISSIONS

Low-level ozone, an important component of smog, is formed when two types of chemicals in fuel emissions — nitrogen oxides ($NO_x$) and volatile organic compounds (VOCs) — act together in the presence of heat and sunlight. Low-level ozone causes respiratory problems, particularly among asthmatics, and damages the foliage of crops and trees.

Transportation contributes about 40 percent of Canada's non-natural emissions of VOCs and 60 percent of its $NO_x$. Diesel-engined trucks and buses make a disproportionately large contribution, yet are subject to far less stringent emission controls than cars.

Although low-level ozone breaks down over a period of hours or days, concentrations can build up where industrial and transportation emissions of $NO_x$ and VOCs are greatest. In addition, low-level ozone, which is wind-borne, can accumulate city by city, polluting entire regions.

In most of Canada's large cities, summer concentrations of low-level ozone occasionally exceed the maximum acceptable National Ambient Air Quality Objectives. In three regions of Canada, however, these concentrations regularly exceed acceptable levels during the summer months. These are the Lower Fraser Valley of British Columbia; the corridor between Windsor, Ontario, and Quebec City, Quebec; and the area surrounding Saint John, New Brunswick.

Ozone can be created locally and can also come from sources upwind. In British Columbia, the ozone is nearly all produced locally. In Southern Ontario and Quebec, the ozone created by local sources is supplemented by ozone from the Great Lakes states of the United States. In southeastern New Brunswick and Nova Scotia, nearly all the ozone moves in from the U.S. Atlantic seaboard, Quebec and Ontario. As mentioned, low-level ozone tends to break down into harmless components after a day or more, so shifting winds, variations in sunlight and other factors account for high pollution levels.

These three regions have been designated as "ozone non-attainment areas" by the Canadian Council of Ministers of the Environment. (Non-attainment areas do not meet Canada's National Ambient Air Quality Objectives.) The federal and provincial governments have targeted non-attainment areas for special control measures as part of a national $NO_x$/VOCs Management Plan (see Volume 2 for a description of current and announced control measures). In the decades ahead, if more action is not taken, additional regions of Canada could face similar problems.

## URBAN SPRAWL

Non-attainment areas are often areas where land use and development patterns, transportation, and pollution are intimately tied together. For example, urban sprawl causes increased fuel consumption and exacerbates environmental pollution problems.

Non-attainment areas often have the following characteristics:

- development is dense;
- urban development spreads to rural areas rather than becoming more concentrated;
- the single-family, lower density, suburban housing pattern is specifically designed around the car and encourages its use; and
- more public transportation is provided than in attainment areas, but public transportation services are concentrated much more in the urban core. For example, transit use is very high in Toronto (use, per capita, is the second highest in North America, after New York City), but outside the city core, cars move the people with some help from buses.

The urban sprawl pattern has disadvantages for public transportation carriers, who require high population densities along their routes in order to be efficient. In turn, lack of public transportation encourages car use, and this becomes the easiest and seemingly most natural choice for short to medium-distance intercity trips.

## GLOBAL WARMING

Although scientists continue to debate the effects of global warming, the Intergovernmental Panel on Climate Change has confirmed the existence of the phenomenon known as the greenhouse effect. The Panel agrees that human activities are creating increased atmospheric concentrations of greenhouse gases: carbon dioxide ($CO_2$), chlorofluorocarbons (CFCs), methane, and nitrogen oxides ($NO_x$). Transportation is a major source of $CO_2$ and CFCs.

*$CO_2$ emissions:* Transportation contributes about 25 percent of Canada's $CO_2$ emissions from non-natural sources, and these originate as by-products of the combustion of carbon-based fuels. Such emissions cannot be controlled by treating exhaust gases, but must be reduced through decreasing fuel consumption or using non-carbon energy sources such as solar energy and hydro-electric power or nuclear energy. Unlike the emissions that contribute to low-level ozone, $CO_2$ can last in the atmosphere for as long as 200 years. Therefore, the cycle of $CO_2$ increase and decrease is much longer, and its potential impact more persistent, than that of low-level ozone. Canada has adopted a goal of stabilizing total greenhouse gas emissions at 1990 levels by the year 2000. This requires a substantial reduction in $CO_2$ from the level that is anticipated if current trends continue unchecked.

*CFCs:* Transportation also adds CFCs to the atmosphere, primarily through leakage from vehicle air conditioners, which have recently contributed about 25 percent of total Canadian CFC emissions. CFCs play a major role in the destruction of the protective high-level ozone layer in the stratosphere (see Volume 2 for a summary of differences between high-level and low-level ozone). Canada is in the forefront of international action on CFCs, having made a commitment to eliminate CFCs by 1997. At present, manufacturers are starting to use other chemicals in car air conditioners.

The Canadian Climate Program Board predicts that, if global warming continues into the next century, Canada's climatic zones may shift northward and sea levels may rise; both effects would have economic and social consequences. Although scientific evidence is not clear regarding global warming, prudence suggests that efforts be made to further reduce fuel consumption. Such efforts can be successful. Despite an increase in traffic and the number of cars, total annual gasoline consumption in Canada today is lower than it was in 1975.

## ASSESSING ENVIRONMENTAL DAMAGE

Scientists find it extremely difficult to measure the effects of transportation on the environment. Use of land for transportation disrupts wildlife habitats, but ecologists cannot gauge the full effects of these changes. Chemicals in vehicle emissions affect people, plants, animals and buildings, but medical scientists, botanists, biologists and chemists cannot determine with accuracy the relationships between doses of chemicals and responses in sickness or damages. Global warming is changing our weather patterns, but atmospheric scientists are unable to predict how much warming to expect, how regional temperatures will change, and how these changes will affect growing seasons, rainfall and sea levels.

Canadians experience the effects of environmental damage from transportation in unequal ways. For example, those living close to major airports must live with noise pollution from airplanes, even though they may never travel by air; their properties are also cheaper for the same reason — noise. Similarly, people who live close to freeways and railway tracks must live with noise pollution and lower property values. Farmers and foresters who work far from urban areas must deal with the effects of foliage damage from air pollution created many kilometres away. Those who live outside cities often travel further to get to educational, vocational, cultural and commercial services than do people living near the centre of the city, yet it is the city-dwellers who must live with the resulting air pollution, noise, disruption from traffic, and inconvenience.

It is difficult to estimate the costs of environmental damage. In rare cases, it is possible to make a direct link between cause and effect, and then estimate the costs. For example, when crop values are diminished due to low-level ozone, a market price for the loss can be calculated.

Some researchers have asked individuals what they would pay in hypothetical situations for improvements in environmental conditions. Others have suggested that clean-up costs be used as a basis for estimating environmental damage. There are examples of public agencies' willingness to bill companies for the costs of treating chemical discharges into waterways. Unfortunately, this approach cannot be applied to all types of damage, particularly irreversible damage. What price can be charged for the loss of a species or in cases where cleanup options do not exist? How can a dollar figure be assigned to the damages caused by global warming? What value can be put on the social and psychological effects of environmental problems caused by transportation? Can a link be made between actions taken by travellers in one region and damage that occurs in another region?

Since researchers cannot advise governments, with certainty, on how much effort it will take to solve environmental problems, the amount of effort to expend remains a question of judgement. In other words, one must judge whether or not the damage reductions are worth the costs while being uncertain about both damage reductions and costs. The trade-offs between costs and damage reductions in current solutions may have to change as knowledge of environmental damage increases. As costs become more measurable, the basis for setting prices for environmental damage will improve.

It is therefore important that governments continue to study, monitor and set goals to reduce environmental damage at the local, provincial, territorial, national and international levels. In addition, more research funding should be directed toward the study of environmental damage effects and costs.

## CONTROLLING ENVIRONMENTAL DAMAGE

At present, there are three ways to reduce the environmental damage associated with transportation.

The first way is to reduce the amount of fuel emissions per unit of travel by improving the technology of vehicles — increasing engine efficiency, treating exhaust to trap or chemically eliminate pollutants, and reducing vehicle weight in order to lower fuel consumption.

The second way is to reduce the volume of traffic by encouraging travellers to switch from cars to public modes in situations where public modes are less environmentally damaging, to reduce the number of trips they take, or to shorten their trips.

The third way is to reduce the effects of damage with remedial clean-ups or by shielding those who are affected (with noise barriers, for example).

Controlling environmental damage is expensive. All three methods cost individuals either as travellers or as taxpayers. Individuals pay for environmental clean-up, motor-vehicle control equipment and its maintenance,[1] administering and enforcing environmental regulations, and subsidizing public modes of travel. Travellers also pay a cost in time and inconvenience if they change modes or types of travel, or relocate residences or places of work.

These costs are likely to increase if the controls on environmental damage become more stringent. The technology to improve fuel consumption or reduce engine emissions further may be very expensive.

Individuals and governments balance the benefits of travel against the costs of controlling environmental damage. Individuals do this when they make travel decisions, purchase vehicles and buy homes. Governments do this when they adopt measures to reduce environmental damage, thus supplementing and modifying individual decisions. Governments take measures such as these because they believe that:

- travellers, who create the environmental damage, do not adequately consider the damage to non-travellers when they make travel decisions;
- many individuals are unable to assess potential damage because of the scientific complexity and uncertainty associated with environmental causes and effects; and

- individual actions may not be extensive enough or coordinated enough to achieve the desired change.

## COORDINATION AND COOPERATION

All levels of government should coordinate their approaches to environmental issues. We support the adoption of explicit goals, such as the national goals for reductions in CFCs, $CO_2$, $NO_x$ and VOCs, for control of environmental damage. We believe, however, that current government decisions can be made more consistently and can achieve these goals at lower costs. We encourage governments to ensure that such goals are realistic, that all concerned are committed to the goals, and that the costs and effectiveness of measures taken to realize these goals are carefully and thoroughly examined.

Governments must be careful about when, where and how they apply environmental controls. For some problems, governments may have to look for regional or local solutions. This is particularly true for pollution problems that occur in specific locations or at certain times. For example, the concentration of carbon monoxide (CO) and diesel particulates is greatest in city centres when traffic is concentrated during windless conditions.

We are particularly concerned about low-level ozone damage in the Lower Fraser Valley in British Columbia, in the corridor between Windsor, Ontario, and Quebec City, Quebec and around Saint John, New Brunswick. As discussed earlier in this chapter, these three areas of Canada have concentrations of low-level ozone that regularly exceed acceptable levels during the summer. It may be costly and unfair to implement uniform national standards to ease this regional problem. The most cost-effective solutions may involve regional controls on vehicle use, travel restrictions at times of greatest damage, or controls on non-transportation sources. British Columbia recently addressed this issue by implementing annual vehicle emission control checks in the Greater Vancouver area. By forcing people to keep cars tuned-up, they are able to reduce emissions without adding special equipment.

Because these areas are especially vulnerable, we **recommend** that:

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**7.1 Governments consider regional solutions to ozone non-attainment areas, including special regional regulations such as speed limits or periodic motor-vehicle emissions testing for all classes of vehicles, and higher emissions surcharges at times of the year when ozone is a problem.**

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We recognize that it may not always be practical to administer and enforce a regional standard — for example, ensuring that all cars within a region are fitted with emissions-control equipment may be difficult. Governments must try to find a balance between obtaining low-level ozone reductions in target regions and imposing unnecessary costs on travellers outside those regions.

For other problems, the strategy for environmental controls must be as broad as possible, encompassing all sources throughout the country, and the world, and extending across all sectors. The potential damage from global warming brought about by $CO_2$ emissions cannot be solved only by local fuel conservation programs. It is a global problem, and all sources of $CO_2$ must be examined to find the most efficient and effective ways to reduce these emissions. We believe that the passenger transportation sector should do its part but not be penalized more than other sectors that also produce $CO_2$. Governments should examine which controls can be applied at the lowest cost for the greatest benefit.

An international strategy to control global warming is being developed under the United Nations Convention on Climate Change, signed by some 150 countries at the Rio Conference in June 1992. Canada's national goal to stabilize $CO_2$ emissions at 1990 levels by 2000 is more stringent than the commitment required so far under that convention.[2]

We therefore **recommend** that:

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**7.2 Canada continue to strive for development of an effective international strategy to control global warming, and seek to harmonize domestic policies and taxes with those of the international community.**

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## PROTECTING THE ENVIRONMENT THROUGH REGULATION AND EDUCATION

In Canada, regulation and education play important roles in reducing environmental damage caused by transportation. Provincial and municipal governments have combined environmental objectives with those of urban and transportation planning. They regulate driving behaviour through traffic restrictions and parking controls, and run campaigns to persuade people to change modes or travel less.

The regulatory approach of the federal government includes controls on vehicle technology — primarily through setting motor-vehicle emissions standards, and obtaining voluntary agreements for improvements — particularly to meet fuel-consumption targets. The federal government also undertakes information campaigns to persuade travellers to change their travel behaviour.

This regulatory approach contributes substantially to lowering emissions. Regulators, however, often concentrate on what is easiest to administer and enforce, rather than on reducing damage for the lowest cost. For example, federal regulation focusses on motor-vehicle emissions, and, in particular, on passenger car emissions. As a result, pollution control is stricter for motor vehicles than for non-vehicular sources.

Governments, however, must be cautious when using a regulatory approach to reduce pollutants. While federal regulatory control of car emissions has been successful, governments should pay equal attention to emissions from other transportation vehicles such as buses, trucks, trains, airplanes and ferries.

Therefore, we **recommend** that:

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**7.3 Governments continue to improve and apply regulations for effective control of environmentally damaging emissions. In doing so, they should ensure that:**

**(a) regulations be set so as to impose similar obligations (in terms of costs per unit of abatement) on each mode in a cost-effective manner;**

**(b) non-transportation sources of pollutants be treated similarly to those in transportation; and**

**(c) the costs of deciding, implementing and administering transportation regulations be paid for by the users of the transportation system.**

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Although urban transportation is beyond our mandate, we believe that Canadians should choose where they want to live on the condition that they pay the full cost of those choices. We note that if, as a result of Canadians facing the full costs of their choices, urban land-use patterns were to change, different travel behaviour might follow. For example, if development in a region were dense and consisted of mixed commercial and residential properties — unlike urban sprawl development — the following would likely occur:

- home-to-work trips would be far shorter, encouraging other means of commuting including walking and bicycling;
- densities would be higher making public transportation more viable;

- land values would be higher and parking scarcer and more expensive, discouraging car use and ownership; and
- the mix of residential and commercial establishments would encourage doing errands by means other than the car.

Reduced levels of car use would also lead to a greater use of any available public transportation for intercity trips. This would result in lower levels of emissions per capita.

## PROTECTING THE ENVIRONMENT THROUGH PRICING

While regulations will continue to play a significant role in protecting the environment from pollution caused by travel, we do not believe that regulation alone will be sufficient. Regulations should be supplemented by charges to travellers, which provide an efficient way of encouraging travel behaviour that will limit damage to the environment. When travellers pay for the damages they inflict on the environment, they will make choices and may change their travel behaviour.[3] Some will travel less to save money. Others will switch to modes that are cheaper because of lower environmental charges. Still others will choose to pay the higher price to travel on the less environmentally friendly mode. Owners of transportation equipment and infrastructure will change their equipment or otherwise adjust to decrease the pollution they cause in order to reduce the environmental costs they have to pay, and, therefore, have to charge.

In addition, environmental charges will encourage transportation providers to conserve fuel or switch to less-polluting fuels. In all cases, travellers would choose their own mix of solutions at the least cost to themselves, but would take into account the damage they impose on the environment.

How should travellers be charged for the damage they inflict on the environment? Like many other aspects of passenger transportation, the issues are complex and the solutions are not easy. It is impossible to estimate the costs of all environmental damage precisely, and therefore to charge travellers accurately for all the damage they cause.

It may be possible, with future technology, to charge passengers directly for the emissions of air pollutants and noise created by their vehicles. This may be done either through monitoring vehicles continuously or through monitoring the distances travelled and combining this with an emissions rating for particular vehicles. The technology to measure vehicle emissions and noise, however, is not yet in general use.

Emissions charges could be what is required to meet Canada's national goals for the environment. We suggest that a practical means of determining prices for emissions charges would be to estimate the charges required to meet Canada's national goals for reducing $CO_2$, $NO_x$ and VOCs. When dealing with emissions charges, it is imperative that the following recommendation be read in conjunction with what we say in Chapter 17 on environmental charges based on global damages and their implications for international competition.

We believe that, for the immediate future, emissions surcharges should be placed on fuel sales.[4] Such emissions surcharges are presently the best and fairest means of charging passenger transportation users for the environmental damage they cause. If imposed at the same rate per unit of emissions from all sources, these surcharges would affect all modes and all fuel sources equally and would be fair. For $NO_x$ and VOCs emissions, the surcharges would apply only in the ozone-sensitive regions, and only during those summer months when ozone levels are damaging. An alternative solution for $NO_x$ and VOCs in sensitive regions might be vehicle registration fees based on estimated annual emissions from the specific vehicle.

We therefore **recommend** that:

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**7.4 Users of transportation pay for the environmental consequences of their actions, such as:**

**(a) actual government costs for creating policies and regulations to prevent damage;**

**(b) environmental clean-up costs or mitigation (e.g. noise abatement);**

**(c) compensation for those affected by environmental damage, where this can be determined; and**

**(d) best estimate of damage where costs cannot be compensated because it is not possible to accurately identify individually those who are affected by environmental damage or the extent to which they have been affected.**

In some cases, estimates of the cost may not be available, but governments may continue to judge it prudent to set goals for pollution control, presumably guided by the social costs of the environmental damage in question. Such goals provide an alternative basis for establishing levels of charges.

We therefore **recommend** that:

**7.5 Where environmental goals have been established in the absence of reliable information on damage costs, charges and/or changes in regulations be set at the levels expected to induce the behavioural change that will meet the goals.**

**7.6 Environmental emission charges be applied equally to all modes of transportation and to non-transportation sources, on as close to a per-unit-of-emission basis as practical.**

We further **recommend** that:

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**7.7 Government clearly separate the revenue that comes from emissions charges from the revenue that comes from other passenger transportation charges, and ensure that:**

**(a) revenues raised from emissions charges be first used to clean up environmental damage from transportation and to compensate those affected, if they can be identified;**

**(b) remaining revenues be used to lower general tax rates; and**

**(c) revenues from emissions charges not be used for transportation system expansion or maintenance.**

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For example, compensation could take the form of screens around transportation structures to reduce noise levels or the provision of a safe means of crossing highways or railways. We also believe that it would be fair to use the funds to provide improved public transport in the inner city, where residents are affected disproportionately from traffic caused, in large part, by those living in the suburbs. Such funds could be used for research into pollution prevention and for education on protecting the environment.

Although urban and freight transportation are beyond our mandate, we believe that these principles of cost-effective regulations and emissions charges should be adopted in urban and freight transportation planning and in other sectors of the economy.

## COMPARISON OF POTENTIAL EMISSION CHARGES BY MODE

For the purposes of illustration, we obtained estimates of emissions for the different modes and calculated the surcharges that might be required to meet Canadian government objectives of reducing $CO_2$ to 1990 levels in the year 2000, and reducing $NO_x$ and VOCs in non-attainment areas in summer. Cars, airplanes, buses and trains emit different amounts of the gases that contribute to air pollution and global warming. Table 7-1 and Chart 7-1 show emissions per passenger-kilometre on two sample intercity routes, a short trip from Toronto to Montreal and a longer trip from Saskatoon to Halifax, for the four passenger modes.

*Table 7-1*

*EXAMPLES OF EMISSIONS BY MODE ON TWO INTERCITY ROUTES*

| EMISSIONS PER PASSENGER-KILOMETRE IN GRAMS, 1989 — TORONTO TO MONTREAL | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Type of emission** | | **Public transportation with current occupancy rates**[a] | | | **Public transportation with all seats filled** | | |
| | Car | Bus | Train | Airplane | Bus | Train | Airplane |
| CO | 5.20 | 0.18 | 0.34 | 0.17 | 0.14 | 0.21 | 0.11 |
| VOCs | 0.94 | 0.05 | 0.14 | 0.10 | 0.04 | 0.09 | 0.07 |
| $NO_x$ | 0.75 | 0.40 | 1.54 | 0.34 | 0.31 | 0.96 | 0.23 |
| $CO_2$ | 128 | 30 | 76 | 220 | 23 | 47 | 148 |

| EMISSIONS PER PASSENGER-KILOMETRE IN GRAMS, 1989 — SASKATOON TO HALIFAX | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Type of emission** | | **Public transportation with current occupancy rates**[b] | | | **Public transportation with all seats filled** | | |
| | Car | Bus | Train | Airplane | Bus | Train | Airplane |
| CO | 5.20 | 0.24 | 0.77 | 0.13 | 0.14 | 0.54 | 0.09 |
| VOCs | 0.94 | 0.07 | 0.32 | 0.08 | 0.04 | 0.23 | 0.05 |
| $NO_x$ | 0.75 | 0.54 | 3.52 | 0.26 | 0.31 | 2.46 | 0.17 |
| $CO_2$ | 128 | 41 | 173 | 167 | 23 | 121 | 113 |

**Sources:** **VHB Research and Consulting Inc., "Environmental Damage from Transportation," Volume 4 of this report, and Royal Commission staff estimates.**

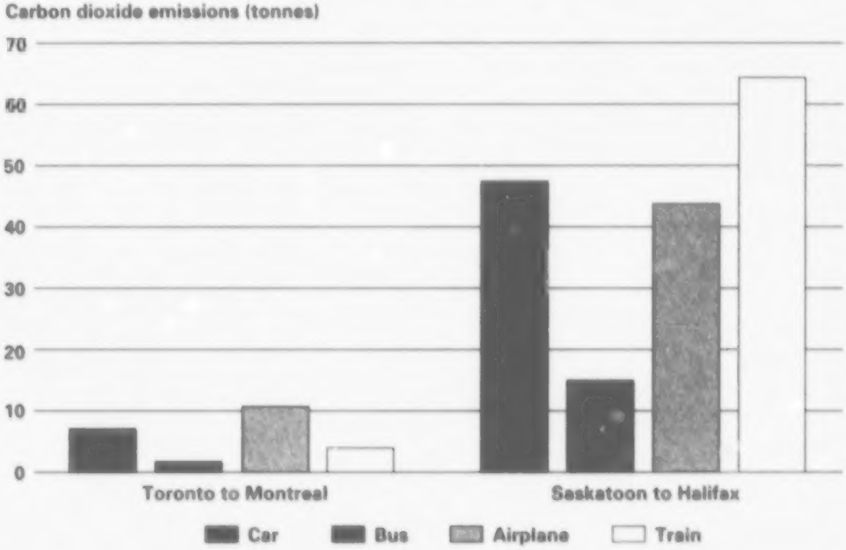
**a.** **Rates at which seats are currently occupied on public transport vehicles are estimated for the Toronto to Montreal route at 77 percent for bus, 62 percent for train and 67.5 percent for airplane. For cars, the occupancy rate is 1.8.**

**b.** **On the Saskatoon to Halifax route, the estimated occupancy rates are 57 percent for bus, 70 percent for train and 67.5 percent for airplane.**

**Note:** **Only direct emissions are included, arising from the trip alone, with no inclusion of indirect emissions from equipment and infrastructure construction. All emissions calculations are based on current vehicles and equipment. If vehicles such as cars and trains were powered by electricity, emissions would depend on the source of electric power.**

*Chart 7-1*

*CARBON DIOXIDE EMISSIONS PER 100 PERSON-TRIPS, BY MODE, TORONTO TO MONTREAL AND SASKATOON TO HALIFAX*



Sources: VHB Research and Consulting Inc., "Environmental Damage from Transportation," Volume 4 of this report, and Royal Commission staff estimates.

Note: Only "direct" emissions are included, arising from the trip alone, with no inclusion of "indirect" emissions from equipment and facilities construction.

Table 7-1 shows that:

- on the shorter Toronto to Montreal trip, airplanes have the lowest emission of CO and $NO_x$, while buses have the lowest emission of VOCs;
- for both long and short trips, buses have the lowest fuel consumption and, therefore, the lowest $CO_2$ emissions;
- on the longer Saskatoon to Halifax trip, airplane emissions are lower per passenger-kilometre than on the shorter trip, while those of buses are higher due to lower occupancy and those of trains are higher due to the use of sleeping cars; and

- current-technology trains have higher emissions of $NO_x$ than any of the other modes, and this would remain the case even if all train seats could be filled.

Tables 7-2 and 7-3 illustrate potential emissions charges and how they might differ by mode for the two trips, Toronto to Montreal and Saskatoon to Halifax. These sample routes are representative of all the types and lengths of trips taken on the transportation system.

We caution readers to be aware that the results shown in Tables 7-2 and 7-3 are extremely speculative. While the federal government has adopted national goals for global warming protection and for ozone control, a method for achieving them through emissions charges has not been designed thoroughly. Governments would have to set charges carefully to induce the appropriate responses by travellers. For our illustration, we have calculated the surcharges on the basis of the government pursuing its announced national goals, relying mostly on charging instead of additional regulation of emissions. As a result, our example charges are high.

For purposes of this illustration, we used a $CO_2$ charge based on $120 per tonne of carbon, which becomes $32.70 per tonne of $CO_2$ emissions, or 7.7¢ per litre of gasoline. This charge would apply everywhere, and year-round. For $NO_x$ and VOCs, we made the assumption that charges would be imposed only in the ozone non-attainment areas, which include the whole of the Toronto to Montreal trip, but only a small portion of the Saskatoon to Halifax trip. The $NO_x$ and VOCs charges should also be applied only during those periods when ozone levels become unacceptably high. We have assumed that, in order to be practical, the charges would need to be applied uniformly throughout the summer months (probably May through August). The illustrative charges in Tables 7-2 and 7-3, therefore, are different for winter and summer.

*Table 7-2*

### ILLUSTRATIVE EMISSIONS CHARGES, IN DOLLARS PER PERSON-TRIP, TORONTO TO MONTREAL

| | **Winter** | **Summer** | | |
|---|---|---|---|---|
| **Carrier** | **$CO_2$ charge ($)** | **$CO_2$ charge ($)** | **$NO_x$/VOCs charge ($)** | **Total ($)** |
| Car | 2.20 | 2.20 | 4.60 | 6.80 |
| Bus | 0.50 | 0.50 | 1.20 | 1.70 |
| Train | 1.30 | 1.30 | 4.50 | 5.80 |
| Airplane | 3.50 | 3.50 | 0.80 | 4.30 |

**Notes:** For this trip, we have assumed the following:

- Toronto to Montreal emissions per passenger-kilometre are as estimated for Table 7-1, based on emissions by current vehicles at current average occupancies (the actual surcharge would vary with the fuel consumption and the occupancy rate of the particular vehicle);
- CO and particulate emissions are not priced for intercity trips, as their damage is urban;
- All levels of government declare it necessary to control ozone by reducing summertime emissions of VOCs and $NO_x$ in this non-attainment area beyond the reductions scheduled in the $NO_x$/VOCs Management Plan, and to a level that they can forecast will be met if a charge of $5,000 per tonne is levied, on all sources in the region; and
- $CO_2$ is charged for separately at a rate of $33 per tonne, or $120 per tonne of carbon, an amount that, if applied to all sectors in Canada, is predicted to achieve stabilization at 1990 levels in 2000.

The above are illustrative estimates of charges that would be associated with existing services. These charges would be lower if emissions were reduced through improved technology. In particular, as discussed in the text below, if trains powered by electricity were used, the charges applicable to trains could be very low (or nil) if the electric power were generated mainly (or entirely) from non-fossil-fuel sources.

The figures for the Toronto to Montreal trip show that:

- year-round charges for $CO_2$ would be lowest for bus passengers and highest for air passengers;
- summer charges for $NO_x$ and VOCs would be lowest per passenger-trip for bus passengers and highest for car passengers;
- total summer charges at the assumed levels would be lowest for bus and highest for car;

- charges would not be large when compared with fares for the public modes;
- the winter charge for $CO_2$ emissions of $2.20 for a car traveller would amount to $3.80 per car (with about 1.7 occupants on average), or 7.5¢ per litre of gas if charged through a gasoline tax. The summer charge of $6.80 for a car traveller would amount to $11.80 per car, or about 23¢ per litre of gas;[5] and
- the summer charge for a car traveller would be only about $1.00 higher than that for a train passenger on this trip.

We recognize that environmental arguments are advanced in favour of introducing conventional or high-speed trains powered by electricity on this route. We obtained estimates of the possible electricity consumption of such trains and considered possible sources of that electricity. To the extent that the electricity could be supplied from hydro-electric plants or nuclear generating stations, trains would produce none of the $CO_2$ or air pollutants created by the other modes. For a high-speed train, if the electricity were generated from fossil-fuelled power stations, it would produce per passenger-kilometre about 64 grams of $CO_2$, 0.3 grams of $NO_x$ and 0.8 grams of sulphur dioxide.[6] Using our illustrative charges, this worst case would create an environmental charge of about $3.60 per passenger-trip in winter and $4.50 in summer.[7] More reasonably, if the electricity was provided from fossil-fuelled plants in proportion to their forecast contribution to the Ontario and Quebec electricity grids in 2000, the surcharge indicated would be only about one tenth of these levels — that is, only about 40¢ per passenger-trip. For an electrified conventional train, power requirements per passenger-kilometre would be even lower, and emission surcharges correspondingly less.

Electrified trains would thus, on average, produce lower environmental costs than any other mode. However, this cost advantage would not be large as a portion of total trip costs. Furthermore, the estimates are only of damage from $CO_2$ and air pollutants, ignoring other environmental damage from hydro-electric and nuclear stations.

*Table 7-3*

ILLUSTRATIVE EMISSIONS CHARGES, IN DOLLARS PER PERSON-TRIP, SASKATOON TO HALIFAX

| | Winter | Summer | | |
|---|---|---|---|---|
| **Carrier** | **$CO_2$ charge ($)** | **$CO_2$ charge ($)** | **$NO_x$/VOCs charge ($)** | **Total ($)** |
| Car | 19 | 19 | 5 | 24 |
| Bus | 6 | 6 | 2 | 8 |
| Train | 25 | 25 | 8 | 33 |
| Airplane | 19 | 19 | 1 | 20 |

**Note:** **The emission factors per unit of fuel consumed are assumed to be the same as in the Toronto to Montreal case, but fuel consumed per passenger differs through different load factors and types of equipment. It is also assumed that the charge per tonne of $NO_x$ and VOCs would only be imposed within the part of the trip through designated ozone-sensitive areas. Other assumptions are the same as for the Toronto to Montreal trip.**

The figures for the Saskatoon to Halifax trip show that:

- $CO_2$ charges would be lowest for bus passengers and highest for train passengers;
- $NO_x$ and VOCs charges would be small relative to $CO_2$ charges, as most of the trip would be outside the ozone non-attainment areas; and
- charges in winter and summer would be lowest for bus passengers and highest for train passengers.

Although transportation will continue to contribute to environmental damage, our recommendations will limit this damage. Implementing regional solutions to ozone non-attainment areas, developing an international strategy on global warming, improving regulations on emissions control and charging fairly for environmental damage will all contribute to protecting Canada's environment.

# ENDNOTES

1. The costs of vehicle-emissions controls are estimated to be about $500 per vehicle, or 0.5¢ per vehicle-kilometre annualized over an average vehicle-lifetime of about 160,000 kilometres.

2. The Convention's objective reads in part (Article 2):

   "The ultimate objective . . . is to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

   Its "commitments" in Article 4 include:

   "Each of the developed country parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objectives of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions and other greenhouse gases . . . "would contribute to such modification . . . ." and

   "In order to promote progress to this end, each of these Parties shall communicate, within six months of entry into force of the Convention for it and periodically thereafter . . . detailed information on its policies and measures . . . as well as on its resulting projected anthropogenic emissions . . . with the aim of reducing individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases. . . ."

   United Nation's Framework Convention on Climate Change, New York, May 15, 1992.

3. Research has proven that collective reactions to gasoline prices are like the reactions for most goods: as the price goes up, the amount bought goes down. In the short term, it does not go down much: a 10 percent price increase might bring only a 2 percent reduction in sales; but over the long term — maybe a few years — the reduction is much larger, perhaps of the order of 8 percent.

   This research might seem contrary to experience. Prices have been continuously rising, but sales don't seem to be falling. This is because we are referring to real increases in prices, that is, in addition to general inflation, and to sales reductions as compared with the level of sales that would have occurred otherwise. When prices are changing routinely because of inflation, and growth in population and vehicle ownership is causing continuous increases in gasoline sales, it is not easy to recognize real price increases and the gradual reduction in sales they produce. But we are confident that the relationships will hold, and that if pollution charges are added to real gasoline prices, sales will be lower.

   Researchers cannot definitively explain the difference between the short-term and long-term effects of price increases, but they suggest that, in the short term, people are locked in patterns of business and social activities. They cannot adjust easily to price increases by driving less or immediately purchasing a different car. Over the longer term, however, when their car comes up for renewal they can replace it with one that is more fuel efficient, and they can change houses or jobs to alter their patterns of car use. They may or may not be aware that they are weighing the price of gas in all these decisions.

4. This would work most effectively for $CO_2$ because its emission rate per unit of fuel is constant. Charging for other air pollutants through fuel-price surcharges would be a less efficient way of changing people's behaviour. This is because the charges could not be tailored to each vehicle's actual emissions, but would have to be averaged for the entire class of vehicles using a particular fuel type — that is, gasoline-fuelled motor vehicles, diesel-fuelled motor vehicles, trains and jet aircraft.

   Such charges could not be reduced by a traveller's or carrier's actions to lower the amount of emissions per unit of fuel, though charges could still be reduced by limiting vehicle use. They would essentially constitute another incentive to reduce fuel consumption.

5. We remind the reader that if our recommendations were implemented in their totality, the result would be a more efficient passenger transportation system, and that while the cost to some travellers would go up, the overall cost to Canadians would be lower. We also caution the reader that this price increase is for gas used only in non-attainment regions in summer.

6. Estimates for a 300 km/hr service, with 75 percent load factor, requiring about 0.10 kilowatt hours per passenger-kilometre.

7. This includes a cost of $6,000 per tonne of sulphur dioxide, derived from the report to the Royal Commission by VHB Research and Consulting Inc., cited in Table 7-1.

# CHAPTER 8

# IMPROVING SAFETY

## INTRODUCTION

Airplane, bus, train and ferry accidents often command eye-catching headlines, but in reality, public transportation is much safer than private transportation. During 1990, 103 Canadians died as a result of an air, train or ferry accident, while 3,957 travellers died and 263,000 were injured in road accidents.[1]

We studied the safety of different modes of travel, and the health and damage costs of accidents. We found, overall, that the safety of our transportation system is improving. The number of accidental deaths from all transportation was lower in 1990 than it was in any year since 1962. Nevertheless, transportation accidents of all kinds cause grief and suffering for many Canadians and are a substantial burden on our society in health and damage costs.

Our principle — that travellers should pay the costs of transportation — means that they should also pay the costs of accidents that are associated with their mode of travel. We have therefore examined safety and accident costs by mode, and who pays for the cost of accidents, safety measures and programs.[2]

## INTERCITY PASSENGER TRANSPORTATION SAFETY

We measured safety by comparing fatalities for each mode relative to passenger-kilometres of travel. We limited our measure to fatalities because comprehensive data on injuries are available only for road vehicles.

Two different measures of safety in passenger transportation are used in this chapter:

- passenger fatality rate: the number of passengers killed per billion passenger-kilometres; and
- fatality rate in passenger operations: the number of persons killed per billion passenger-kilometres, including passengers, crew and others such as bystanders, cyclists and occupants of other vehicles.

## AIRPLANE SAFETY

How safe is commercial aviation? Commercial air travel in Canada is organized into three categories of carriers based primarily on the number of passengers carried annually:[3]

- Level 1 carriers each transport more than one million passengers annually;[4]
- Level 2 carriers each transport 50,000 to one million passengers annually;[5] and
- Levels 3 to 6 carriers include all other small commercial operations.[6]

*Table 8-1*

*FATALITIES DUE TO COMMERCIAL AIRPLANE ACCIDENTS, 1981–1990*

| Level of carrier | Number killed |
|---|---|
| Levels 1 and 2 | 68<br>(57 passengers, 11 crew) |
| Levels 3 to 6 | 539<br>(270 passengers, 269 crew) |
| **Total** | **607** |

**Source: Transportation Safety Board of Canada.**

From 1981 to 1990, 607 people died in accidents involving Canadian-owned commercial air carriers. The figures for levels 1 and 2 carriers in Table 8-1 include single accidents at Cincinnati, Ohio, in 1983[7] and Dryden, Ontario, in 1989 that dramatically raised the fatality rate in the years those accidents occurred. Such accidents make it difficult to calculate fatality rates that indicate trends in aviation safety. Nevertheless, to identify the risks to air travellers in recent years, we averaged total fatalities relative to the number of passenger-kilometres travelled over the decade (Table 8-2).

*Table 8-2*

*COMMERCIAL AIRPLANE FATALITIES PER BILLION PASSENGER-KILOMETRES, 1981–1990*

| **Level of carrier** | **Percentage of passenger-kilometres flown by all commercial carriers** | **Passenger fatality rate (passenger deaths only) per billion km** | **Fatality rate in passenger operations (passenger and crew deaths) per billion km** |
|---|---|---|---|
| Level 1 | 88.0 | 0.05 | 0.05 |
| Level 2 | 8.5 | 0.7 | 1.0 |
| Levels 1 and 2 | 96.5 | 0.11 | 0.13 |
| Levels 3 to 6[a] | 3.5 | 14.0 | 28.0 |

**Sources: Fatalities are from Transportation Safety Board of Canada. Passenger-kilometres are from Statistics Canada, Catalogue No. 51-002 and 51-006.**

**[a] Passenger-kilometres are available only for levels 3 and 4 carriers, but passenger traffic carried by levels 5 and 6 operators is likely so small that it would not affect these rounded fatality rates.**

The figures in Table 8-2 show that:

- Level 1 carriers had a passenger fatality rate equivalent to one death in every 20 billion passenger-kilometres;[8]
- Levels 1 and 2 carriers had a passenger fatality rate equivalent to one death every 9 billion passenger-kilometres; and
- Levels 3 to 6 carriers had the largest passenger fatality rate, equivalent to one death every 0.07 billion passenger-kilometres.

While fatality rates for all commercial aviation fell between 1981 and 1990, the observed improvement in safety was among smaller carriers. Accidents involving levels 1 and 2 carriers are so rare and vary so much from year to year that it is impossible to determine whether or not the carriers' safety improved during this decade. Nevertheless, it is clear that levels 1 and 2 carriers remain much safer than levels 3 to 6 carriers.

From 1981 to 1990, 556 people died in accidents involving private airplanes. There are no figures for passenger-kilometres flown for private aviation. The only indicator of annual activity is the total number of hours flown for all private aircraft regardless of the number of passengers. This figure reveals that private flying has declined during the last decade. The number of fatal accidents per year also appears to have fallen, but the figures are so variable that it is not possible to establish any trends in the accident rates during the decade.

Risks in private flying can be compared with those of commercial aviation, using average rates of fatal accidents per million flying hours. As Table 8-3 shows, there were 33 accidents per million hours of private flying and only 1 accident per million hours for levels 1 and 2 carriers.

*Table 8-3*

*NUMBER OF FATAL ACCIDENTS PER MILLION FLYING HOURS,[a] 1981–1990*

| Type of carrier | Number killed per million flying hours |
|---|---|
| Private flying | 33.0 |
| Levels 1 and 2 carriers | 0.9 |
| Levels 3 to 6 carriers | 17.0 |

**Source: Transportation Safety Board of Canada.**

[a] **This ratio is a customary measure in the aviation industry of airframe and engine performance, but note that it refers to the number of accidents (crashes) in which deaths occurred, rather than the number of people killed, used otherwise throughout this chapter. This is believed to be appropriate as no measure of passenger activity is available for private flying.**

No official statistics exist for fatality rates per passenger-kilometres for private aircraft, and no distinction can be made between their use for transportation and recreation. However, based on the number of flying hours, the fatality rate for private aircraft appears to be much greater than the 20 deaths per billion passenger-kilometres for cars.[9]

Has airline deregulation affected commercial air carrier safety? Airline deregulation — the removal or relaxation of economic regulation of airline operations, such as easing entry to markets and removing price constraints — began in Canada in 1984. Regulation of airline safety, however, remained and has been strengthened since then. To date, there is no evidence that economic deregulation has affected airline safety. We note, though, that it takes a substantial period of time (a decade or more) to identify changes in safety trends, because accidents involving larger carriers are so rare.

Since we did not have sufficient statistics to determine with confidence how airline deregulation has affected Canadian air carrier safety, we turned to research in the United States, where economic deregulation began in 1978, six years before it was introduced in Canada. U.S. research suggests that deregulation in that country has not affected airline safety, and that accident rates continue to follow the downward trend established before deregulation.[10] Furthermore, the increase in air travel, which resulted partly from travellers flying instead of driving, substantially reduced the number of trips by car (a more dangerous mode) and improved overall safety.[11]

## TRAIN SAFETY

We found it difficult to determine any meaningful trends in fatalities per passenger-kilometre for intercity passenger trains. Deaths in collisions and derailments are too rare to determine accurately the safety trends for short periods. For example, there were no passenger deaths in eight of the years from 1981 to 1990. In 1986, however, there were 16 passenger deaths and 8 crew deaths in the Hinton, Alberta, crash (Table 8-4).

*Table 8-4*

*TRAIN FATALITIES PER BILLION PASSENGER-KILOMETRES, 1981–1990*

| Passenger fatality rate (passenger deaths only) | Fatality rate in passenger operations (deaths of passengers, crews and others)[a] |
|---|---|
| 0.8 | 13.8 |

**Sources: Fatalities are from Transportation Safety Board of Canada. Passenger-kilometres are from Statistics Canada, Catalogue No. 52-003 and 52-215, and unpublished data.**

**a. 175 people died in rail-grade crossing accidents, usually in motor vehicles, and 133 were killed trespassing on rail property. Many trespassing deaths may have been suicides, but the Transportation Safety Board's statistics do not distinguish them.**

## BUS SAFETY

Statistics describing the safety of intercity bus operations are scarce. Only five provinces — Saskatchewan, Manitoba, Ontario, Nova Scotia and Newfoundland — have recorded intercity bus accidents separately from those of city transit buses.

Table 8-5 presents data from these five provinces, but the available information does not cover the decade from 1981 to 1990 — only the three years from 1985 to 1987. Clearly, these data do not provide a sufficient basis to identify any long-term trends.

*Table 8-5*

*FATALITIES AND INJURIES INVOLVING INTERCITY BUSES, 1985–1987*

*(SASKATCHEWAN, MANITOBA, ONTARIO, NOVA SCOTIA, NEWFOUNDLAND)*

| | Passenger | Driver | Others[a] | Total |
|---|---|---|---|---|
| Deaths | 0 | 0 | 7 | 7 |
| Injuries | 73 | 27 | 165 | 265[b] |

**Source: Transport Canada special tabulation.**

**a. Primarily drivers and passengers in cars and light trucks that collided with buses.**

**b. Only 4 of the bus occupants and 17 of the other victims were injured severely enough to require hospitalization.**

We could not obtain the number of passenger-kilometres travelled by bus for the five provinces and, therefore, could not accurately determine the rates of death and injury per vehicle-kilometre and passenger-kilometre. Based on data for the number of bus trips and kilometres travelled throughout the entire bus industry, we have estimated an average fatality rate for this three-year period. From 1985 to 1987, there were roughly two deaths per billion passenger-kilometres for all victims, whether passengers, drivers or others. Although there were no passenger deaths in the five provinces from 1985 to 1987, bus crashes can cause passenger fatalities.[12]

We have made a rough estimate of bus safety in order to compare it with the other modes: across the whole country and over a longer period of time, the true number of fatalities from travelling by bus could be placed between 0 and 50 percent of all bus-related deaths. This results in a passenger fatality rate of 0.0 to 1.0 deaths per billion passenger-kilometres (Table 8-6).

*Table 8-6*

*ESTIMATED INTERCITY BUS FATALITIES PER BILLION PASSENGER-KILOMETRES, 1985–1987*

| Passenger fatality rate[a] (passenger deaths only) | Fatality rate in passenger operations (deaths of passengers, crew and others) |
|---|---|
| 0.0–1.0 | 2.0 |

**Source: Passenger-kilometres are from Royal Commission staff estimates.**

**a. Not calculated from actual fatalities, but estimated as noted in the text.**

The majority of victims of bus accidents are not the bus passengers but the drivers and passengers of cars and light trucks involved in the accidents. Improvements to cars and light trucks and seat-belt use have assisted occupants of those vehicles to avoid and survive crashes. As cars and light trucks continue to become safer, travel by intercity bus will be safer primarily for others, but also for bus passengers.

## FERRY SAFETY

There were only six passenger deaths on ferries from 1981 to 1990, four of which were suicides. Crew deaths were even more rare. In all ferry operations, crew deaths averaged one third of the number of passenger deaths.

The annual numbers of fatalities on ferries are much too small and variable for trends to be recognized, or risks to be computed with confidence. Combining the average fatalities per year during the decade with the estimated traffic of 850 million passenger-kilometres in 1988, we were able to estimate the risks. Excluding suicides, the fatality rate in ferry operations (in crew, as well as passengers) was about 0.5 deaths per billion passenger-kilometres. The passenger fatality rate was 0.2 deaths per billion passenger-kilometres (Table 8-7).

*Table 8-7*

*Ferry Fatalities per Billion Passenger-Kilometres, 1981–1990*

| Passenger fatality rate (passenger deaths only) | Fatality rate in passenger operations (deaths of passengers and crew) |
|---|---|
| 0.2 | 0.5 |

**Sources:** Fatalities are from Transportation Safety Board of Canada. Passenger-kilometres are from carrier annual reports and Royal Commission staff estimates.

## CAR SAFETY

People driving private cars, vans and light trucks account for around 80 percent of intercity travel and 98 percent of the deaths related to intercity travel. Based on available data, we have calculated the passenger fatality rate and the fatality rate in passenger operations for 1989 (Table 8-8).

Table 8-8

CAR FATALITIES PER BILLION PASSENGER-KILOMETRES, 1989

| Passenger fatality rate (drivers and passengers) | Fatality rate in passenger operations |
|---|---|
| 10.0 | 13.0 |

Sources: Highway car fatalities are from Transport Canada. Passenger-kilometres are from Royal Commission staff estimates.

While the high rate of fatalities from road accidents concerns us, there are positive trends in road safety. The growth in fatalities has been much less than the growth in traffic. Although there are 14 times as many cars on the roads today as there were in 1930, the number of road deaths has only tripled. Improvement has been especially rapid in the past 20 years. Since 1973, the risk of death from car use has fallen faster than traffic has grown. The result is that the number of people killed has decreased annually.

## COMPARISON OF SAFETY BY MODE

Table 8-9 illustrates the passenger fatality rate and the fatality rate in passenger operations for all modes.

Table 8-9

ESTIMATES OF RECENT[a] INTERCITY FATALITY RATES BY MODE (PER BILLION PASSENGER-KILOMETRES)

| Mode | Passenger fatality rate[b] | Fatality rate in passenger operations[c] |
|---|---|---|
| Air — Level 1 carriers[d] | 0.05 | 0.05 |
| Air — Level 2 carriers[d] | 0.7 | 1.0 |
| Air — Levels 3 to 6 carriers[d] | 14.0 | 28.0 |
| Train | 0.8 | 13.8 |
| Bus | 0.0–1.0 | 2.0 |
| Ferry | 0.2 | 0.5 |
| Car | 10.0 | 13.0 |

Sources: Tables 8-2, 8-4, 8-6, 8-7 and 8-8.

a. Based on the 1980s as a whole or recent years in 1980s; see text and source tables.
b. Includes only passengers killed.
c. Includes passengers, crew and bystanders killed during passenger operations.
d. Includes all Canadian-registered carrier operations, domestic and international.

The figures show that:

- It is safer to travel on Level 1 air carriers than on any other mode.
- Cars cause about 12 times as many passenger deaths over the same distance as trains; at a minimum, 10 times as many deaths as intercity buses that operate on the same road system; and about 90 times as many deaths as levels 1 and 2 air carriers combined.
- Travel using major airlines, buses, trains or ferries is safer than travel by private car or private airplane. Private flying is probably much more dangerous than intercity car travel.

Table 8-9 includes only system-wide averages. The risks of travel also depend on the type of trip and its length. When governments contemplate transportation investment, they should take into account these system-wide safety rates, and should recognize that other factors, such as type of trip, can affect the contribution to safety of individual projects. We believe that traffic on intercity routes would, on average, be safer if some travellers switched from travelling by car to bus, train, or airplane. There might also be safety gains if some travel shifted from train to airplane, or from bus to airplane.

## THE COSTS OF ACCIDENTS

Most estimates of losses caused by transportation accidents are for road accidents.

In this section, we use Transport Canada's calculations of the property damage, lost work and health care costs associated with all road accidents and casualties. They are as follows:

*Property damage costs:* Data come from the claims records of insurance companies, and include allowances for unclaimed damage.

*Lost work costs:* Data come from durations of disability and average expectations of lifetime income, with allowance made for unpaid work performed in or outside of the home.

*Health care costs:* Estimates of these costs are derived primarily from records of payment by provincially owned motor-vehicle insurance administrations in British Columbia and Quebec.

Table 8-10 illustrates the estimated minimum loss per victim for death or injury. The losses arise mainly from lost work (including unpaid work at equivalent market values).

Table 8-10

ESTIMATED MINIMUM AVERAGE LOSSES PER VICTIM (ROAD), 1990

| Severity of injury | Loss per victim ($) |
|---|---|
| Fatal | 330,000 |
| Non-fatal | 10,000 |

**Sources: J.J. Lawson, "The Costs of Road Accidents and Their Application in Economic Evaluation of Safety Programs," Transportation Forum of the Roads and Transportation Association of Canada, V.2 (1980), pp. 53-63; J.J. Lawson, *The Valuation of Transport Safety* (Ottawa: Transport Canada, May 1989) Report TP 10569.**

Table 8-11 provides data on the components of costs, averaged per accident. Because accidents on average have more than one victim, the average costs per accident are higher than those per victim. There are about 115 fatalities for every 100 fatal accidents, and nearly 150 injured victims for every 100 injury accidents.

Table 8-11

ESTIMATED MINIMUM AVERAGE LOSSES PER ACCIDENT BY TYPE OF LOSS (ROAD), 1990

| Class of accident | Number of accidents | Health care ($) | Work loss ($) | Property damage ($) | Total ($) |
|---|---|---|---|---|---|
| Fatal | 3,440 | (few) | 400,000[a] | 10,000 | 410,000[a] |
| Injury | 178,854 | 2,000–3,000 | 12,000 | 10,000 | 25,000 |
| No injury | 650,000 | nil | nil | 5,000 | 5,000 |

**Sources: J.J. Lawson, "The Costs of Road Accidents and Their Application in Economic Evaluation of Safety Programs," Transportation Forum of the Roads and Transportation Association of Canada, V.2 (1980), pp. 53-63; J.J. Lawson, *The Valuation of Transport Safety* (Ottawa: Transport Canada, May 1989) Report TP 10569.**

**a. "Work loss" and therefore "totals" are uncertain.**

Table 8-12 estimates the minimum total losses for all road accidents in 1990, indicating that health care accounted for $500 million, work losses for $3.5 billion, and property damage for $5 billion.

*Table 8-12*
*ESTIMATED MINIMUM TOTAL LOSSES IN ALL ACCIDENTS BY TYPE OF LOSS (ROAD), 1990*

| Class of accident | Number of accidents | Health care ($ billions) | Work loss ($ billions) | Property damage ($ billions) | Total ($ billions) |
|---|---|---|---|---|---|
| Fatal | 3,440 | (few) | 1.4 | (few) | 1.4 |
| Injury | 178,854 | 0.5 | 2.1 | 1.8 | 4.4 |
| No injury | 650,000 | nil | nil | 3.2 | 3.2 |

**Sources: J.J. Lawson, "The Costs of Road Accidents and Their Application in Economic Evaluation of Safety Programs," Transportation Forum of the Roads and Transportation Association of Canada, V.2 (1980), pp. 53-63; J.J. Lawson, *The Valuation of Transport Safety* (Ottawa: Transport Canada, May 1989) Report TP 10569.**

The value of improved safety can be determined by estimating what people are willing to pay to reduce or avoid the risk of death. To do this, calculations are made using the following sources:

- additional wages received by workers in risky jobs;
- amounts paid by consumers for safety devices; and
- amounts individuals say they would pay to reduce a risk.

Some researchers have suggested that the value of life is in the $1 million to $3 million range. The debate on the value of life remains unresolved. The result is that governments around the world plan safety investments using different values.[13]

Transport Canada currently uses $1.5 million as a value per death avoided. If this amount reflects the social costs of the grief and suffering caused by an accident, as well as the costs of physical damage, lost work and health care, it would raise the total estimated annual accident cost shown in Table 8-12 from $9 billion to $14 billion.

## WHO PAYS FOR ACCIDENT COSTS?

Transportation vehicle users, owners and carriers today pay for 95 percent of the costs that result from property damage and work loss caused by road accidents. They pay through:

- mandatory third-party liability insurance to cover the losses of others in accidents;[14]
- personal collision insurance, which is optional;
- payment of deductible amounts in their insurance policies; and
- payment for uninsured damages.

Travellers pay the cost of accidents if their insurance compensates all losses fully and if the annual premium accurately represents the expected loss per year. The insurance company charges an annual premium based on the expected loss that year. In this manner, travellers facing similar risks share the costs occurring in any one year.

Do travellers pay for all the accident costs they incur? Not entirely, for three reasons:

- Insurance companies do vary the premium rates with different accident experiences but not by enough to avoid all cross subsidization. They spread risks too broadly among travellers with different accident experiences. While the *Canadian Charter of Rights and Freedoms* and some provincial legislation deter insurance companies from varying their rates according to sex and age, there remains scope for greater differentiation of insurance rates according to such factors as previous accident claims and traffic violations, area of residence, model of vehicle and annual distance travelled.
- Compensation to victims is not complete. Insurance pays only for losses deemed to have occurred, and the method for determining such losses differs from province to province. For example, the motor-vehicle insurance agency in Quebec provides generous

compensation for income losses to victims who are not employed. In Ontario, the no-fault system has low limits on many classes of compensation. Other provincial or territorial insurance systems also have caps on levels of compensation.

- Some accident costs are paid by others and not by those responsible. This is particularly true of health care costs, which are paid primarily by taxpayers. In 1990, the total health care cost from accidents was about $500 million (Table 8-12). Of this total, about $300 million was paid by provincial health-insurance plans, and only $200 million was recovered from motor-vehicle insurance companies.

The $300 million not recovered from transportation users is small in relation to total accident losses of $9 billion, and represents only 5 percent of total accident damage. Charging this amount to users would add 0.25¢ per vehicle-kilometre, or about $40 per vehicle per year to insurance premiums.

## WHO PAYS FOR THE COST OF ACCIDENT PREVENTION?

### INFRASTRUCTURE DESIGN AND SERVICES

When transportation providers design infrastructure to accommodate traffic capacity, they also build in a substantial amount of safety. The design of runways includes lengths and widths that are safe for landings and take-offs, and the design of roads has alignments, shoulders, and medians to provide safe driving conditions. Transportation infrastructure also includes navigation equipment, road barriers, markings and traffic control devices — all designed for both capacity and safety. Some services, such as emergency response systems, are strictly safety-oriented.

In general, the infrastructure provider bears the initial costs of design and safety features. Who ultimately pays depends on the extent to which the infrastructure provider tries to recover costs from travellers.

In general, taxpayers pay for the unrecovered costs of government-provided infrastructure through federal, provincial, territorial and municipal taxes.

### REGULATION OF OPERATORS AND PERFORMANCE

Government regulation of vehicle operators and vehicle performance is based on concerns that the marketplace alone cannot protect society's safety interests. For example, there are regulations to:

- protect innocent bystanders from reckless operators;
- protect passengers on public transportation from risks over which they have no control;
- protect vehicle purchasers who are unable to ascertain the safety performance of vehicles and equipment;
- overcome manufacturers' resistance to the expense of incorporating safety innovations in their equipment; and
- ensure that individuals protect themselves. For example, they require car drivers and passengers to use seat belts, motorcyclists to wear helmets, and children to use seats with child restraints.

In general, travellers today do not pay directly for the costs that governments incur in developing, monitoring and enforcing regulations. These costs include administering registration systems, testing vehicles and craft, and, most significantly, enforcing traffic regulations. In 1987, the most recent year for which we have data, the cost of police enforcement in Canada for safety regulations was approximately $450 million.

## RECOMMENDATIONS

As set out in Chapter 4, safety is an objective of the passenger transportation system. Therefore all safety costs should be incorporated into the price paid by travellers in each mode.

The health care system in Canada is intended to provide universal coverage. User-pay is consistent with this principle. We believe that charges can be levied on specific activities that contribute to health care costs. This will reduce the funds that need to be provided to the health care system from general tax revenues and health care taxes and premiums. The Canadian taxpayer also bears most of the government cost of developing, monitoring and enforcing regulations that promote transportation safety. We believe that travellers should also pay for these costs.

We therefore **recommend** that:

**8.1 Travellers pay for all safety and accident costs, including:**

**(a) health care costs related to passenger transportation currently borne by the health insurance system; and**

**(b) the cost of safety services provided by governments.**

Provincial and territorial authorities may already be setting their vehicle licence fees to include regulation costs, particularly for police enforcement. If they are doing so, these costs are not evident to the public. We believe that it is feasible for the provinces to account for those costs more specifically and to include them in the prices they charge to transportation users.

Until recently, Transport Canada used widely differing values for the different modes in assessing safety improvements and evaluating spending proposals. For example, the values of life and of various injuries used in aviation safety decisions were several times higher than those used in road safety decisions. Whether this difference in values led to any large distortion in government spending by mode is not clear. We think it likely, however, that government spending priorities would have been different if, for example, the aviation values had been used to assess investments, regulations and other policies across all modes.

Furthermore, it appears that the provinces also made spending decisions on improvements for road safety based on Transport Canada's road values. Had aviation values been used instead, highway safety investments might have increased substantially.

This possible federal bias towards aviation safety and against road safety may be eliminated now that the Department has proposed a uniform value for all modes.

To ensure this, we **recommend** that:

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**8.2 All responsible agencies use comparable values for injury and loss of life when evaluating spending proposals for safety improvements in different modes.**

# ENDNOTES

1. Other accidents in private vehicles are excluded from these figures (for example, those killed or injured in private flying, private boating and non-passenger shipping).

2. For more detailed information on the modes of travel, general developments in safety, and comparisons of safety risks by mode, see Volume 2.

3. The following statistics describe the safety of Canadian-registered carriers, including their foreign as well as domestic operations, and do not represent operations in Canada of foreign carriers. Note that carriers can also be designated as level 1 or 2 on the basis of tonnes of freight carried.

4. This category includes the two major airlines, Air Canada and Canadian Airlines International Ltd., and two feeder airlines, Air BC and Time Air.

5. This category currently includes 24 major (feeder and charter) air carriers, including for example, Nationair, Canada 3000 Ltd., Air Nova and Air Ontario.

6. This category currently includes some 844 smaller operators, including such companies as Air Creebec, Labrador Airways and Athabaska Airways. Only a minority of these companies appear to provide scheduled passenger service. Few data are available on the almost 600 operators in levels 5 and 6.

7. These statistics include accidents to Canadian carriers whether occurring in Canada or abroad.

8. A death rate of 0.05 per billion passenger-kilometres converts to 1 death per (1 billion ÷ 0.05 =) 20 billion passenger-kilometres.

9. In the decade 1981 to 1990, 9.6 million hours of private flying time were logged. If the aircraft averaged 250 to 300 kilometres per hour and 2 to 3 passengers, the 556 private-flying deaths during the decade would indicate a fatality rate of 60 to 120 deaths per billion passenger-kilometres.

10. Some U.S. observers had been concerned that deregulation would increase accident risks because traffic from the safer major carriers would switch to less-safe commuter carriers. This fear has not been substantiated. While switching has occurred, most traffic shifted to larger commuter carriers, whose accident rates were below the average for commuter carriers.

    Also, the higher fatality rates for commuter carriers reflect, in general, their shorter trip lengths and greater number of take-offs and landings, which is when airplanes are at most risk of crashing. Following deregulation, commuter airlines became part of the hub-and-spoke pattern of airline routing, whereby travellers fly to a central airport (the hub) and change planes to travel to other destinations via the spokes. The somewhat unexpected result was that the overall number of stops on a typical passenger's flight was reduced, thereby improving the commuter carriers' safety.

    Overall, researchers conclude that, while the increase in commuter traffic possibly worsened average risks per passenger-kilometre compared with what might have been achieved without deregulation, air safety continued to improve.

11. See L.F. Bylow and I. Savage, "The Effect of Airline Deregulation on Automobile Fatalities," *Accident Analysis and Prevention* 23 (5), October 1991, pp. 443-52.

12. Verbal communication from those responsible for Transport Canada's motor vehicle accident investigation teams.

13. Until recently, different values were even used within Transport Canada. Aviation investment analysts placed a value on death avoided that was several times higher than the value used in evaluating motor vehicle regulations and highway investments. Uniformity was established when the Department adopted a standard value of $1.5 million (in 1991 dollars). That figure is essentially a median value among those previously used, and Transport Canada makes no claim to have resolved the problems of measuring the value of life.

14. There are provincial variations regarding insurance. Some provinces have no-fault insurance programs: Ontario for all third-party damage, Quebec for all injury, and others with elements of no-fault in agreed payment schedules for specified damages.

    In addition, British Columbia, Saskatchewan and Manitoba have provincial insurance companies for all motor-vehicle insurance, and Quebec has a provincial scheme for injury damage, leaving property damage to private-sector insurance companies. All provinces have no-fault hospital-medical insurance schemes that provide health care for victims regardless of who was responsible for the accident.

# CHAPTER 9

# EASING THE WAY: ACCESS TO TRANSPORTATION FOR PEOPLE WITH DISABILITIES

## INTRODUCTION

Our public hearings and review of submissions made us keenly aware that many Canadians with disabilities must struggle to gain access to transportation services. For example, some feel cut off from public transportation because it is difficult to find appropriate seating or to get on and off buses, trains and airplanes. Others have problems moving around terminals, hearing announcements or reading signs. For many, travel becomes so arduous that they are unable to use public transportation at all.

Canadians with disabilities believe that equal access to transportation will allow them to lead more independent and productive lives. When these Canadians spoke with us about their difficulties with the transportation system, many said that they are unable to travel to educational, vocational, cultural and commercial facilities in and beyond their communities. They asked for the same access, comfort and dignity that other Canadians take for granted. They also made numerous suggestions on how access to the passenger transportation system could be improved.

## THE CURRENT SITUATION: FRUSTRATION AND PROGRESS

### THE PEOPLE MOST AFFECTED

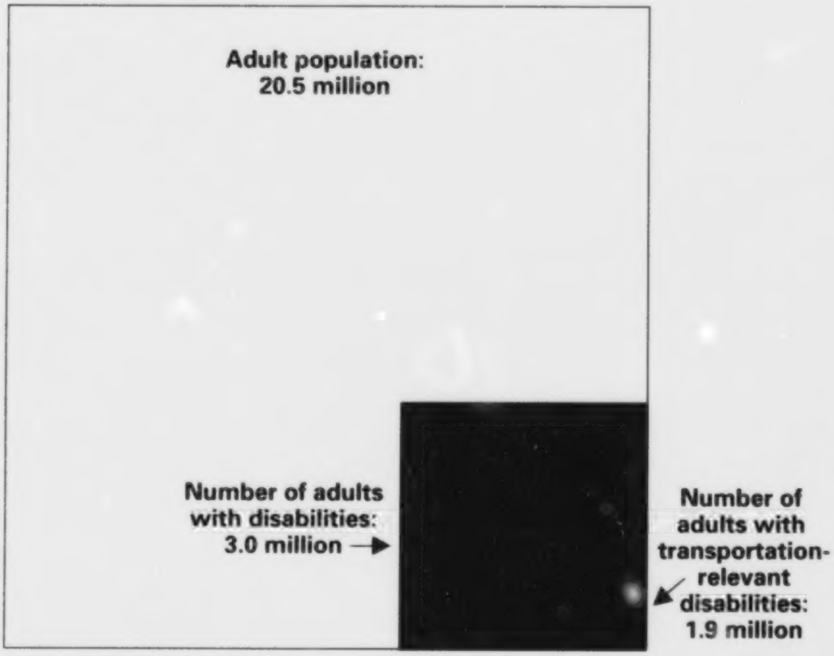
Chart 9-1 shows the relationship between the adult Canadian population, the component composed of people with disabilities, and the number of Canadians in this smaller population who have transportation-relevant disabilities.[1] This latter group accounted for nearly 10 percent of the adult population, and 63 percent of adults with disabilities (or about 1.9 million people) in 1990.[2]

The amount of change required to improve accessibility for people with disabilities differs depending on the nature of the disability. In some cases, specialized training of transportation personnel is sufficient; in others, additional or modified equipment is necessary.

Table 9-1 provides an estimate of the number of Canadians with transportation-relevant disabilities, by type of disability. In 1990,

*Chart 9-1*

*NUMBER OF ADULTS WITH DISABILITIES AND WITH TRANSPORTATION-RELEVANT DISABILITIES, 1990*



**Source:** Hickling Corporation, ***Transportation for People with Disabilities: A Policy Review and Analysis***, **a report prepared for the Royal Commission on National Passenger Transportation, RR-01, March 1991.**

adult Canadians who have to use wheelchairs or walkers when they travel numbered an estimated 132,660, or 7.1 percent of those with transportation-relevant disabilities.

*Table 9-1*

**NUMBER OF PERSONS WITH TRANSPORTATION-RELEVANT DISABILITIES, BY TYPE OF DISABILITY, 1990**

| | Number | Percent[a] |
|---|---|---|
| All Canadians aged 15 and over with transportation-relevant disabilities | 1,879,615 | 100.0 |
| Mental disability | 714,398 | 38.0 |
| Hearing impairment | 648,780 | 34.5 |
| Sight impairment | 417,990 | 22.2 |
| Speech impairment | 159,843 | 8.5 |
| Wheelchair or walker use | 132,660 | 7.1 |
| Blindness | 42,176 | 2.2 |
| Disability unspecified | 37,052 | 2.0 |

Sources: Hickling Corporation, using data from Statistics Canada's Health and Activity Limitation Survey, 1987, with projections to 1990; *Transportation for People with Disabilities: A Policy Review and Analysis*, a report prepared for the Royal Commission on National Passenger Transportation, RR-01, March 1991, p. 5.

a. Figures will add to more than 100 percent because some people have multiple disabilities. Figures include people living in institutions but exclude those confined to the home (an estimated 37,600).

Today, Canadians over 65 years old make up only 11 percent of the population but account for nearly 37 percent of those with disabilities.[3] By the early part of the next century, that 11 percent will rise to 18 percent — about 6 million people. It is likely that there will be a proportionate increase in the number of Canadians with disabilities.[4] This poses challenges for governments today, and for transportation providers who must plan for the future use of transportation infrastructure and services.

## EXPECTATIONS FOR IMPROVEMENT IN ACCESS

There have been several pieces of legislation in Canada and the United States in recent years that raised expectations of rapid improvements in access to transportation for people with disabilities. In Canada, Parliament passed the *National Transportation Act, 1987,* which states that no carrier or mode of transportation under federal jurisdiction "so far as practicable" should allow "an undue obstacle to the mobility of persons, including those persons who are disabled."[5] The Act also gives the National Transportation Agency responsibility for "eliminating undue obstacles in the transportation network governed by this Act to the mobility of disabled persons."[6] In the United States, Congress passed the *Americans with Disabilities Act of 1990*. With respect to passenger transportation, this Act requires carriers to meet, over specified time periods, standards of accessibility for people with disabilities.[7]

In Canada, people with disabilities expected that the Canadian legislation plus the influence of the American legislation would bring about quick and considerable improvements in their access to passenger transportation. This did not happen. It has taken five years for the federal government to publish, for comment, proposed regulations aimed at improving access to transportation services for people with disabilities. These proposed regulations apply only to the domestic carriage of people with disabilities in aircraft with 30 or more passenger seats and to programs for carrier personnel training.[8]

## WHAT PROGRESS HAS BEEN MADE?

People with disabilities and those who support their efforts to improve accessibility are putting pressure on governments and industry in different countries to recognize that they are entitled to equality with those who do not have a disability. In the United States, for example, Vietnam veterans' groups were active in the movement that led Congress to enact the *Americans with Disabilities Act of 1990.*

In Canada, several pieces of legislation address issues of importance to those with disabilities. Two that provide a measure of protection are the *Canadian Charter of Rights and Freedoms* and the *Canadian Human Rights Act.*[9] The provisions relevant to transportation, however, require the traveller with a disability to seek access, rather than placing the onus on service providers to ensure it. Furthermore, under this legislation, knowledge of lack of access is not sufficient grounds to seek redress — a person with a disability must first have been refused access. In contrast, the *National Transportation Act, 1987* provides authority to initiate action to require transportation carriers to eliminate undue obstacles.

Government and industry are improving access, but progress is slow. Although legislation and regulation provide incentives, we have found that improvements are often begun hesitantly and implemented slowly. We note, however, the following efforts on behalf of travellers with disabilities.

### The National Transportation Agency[10]

In line with the responsibilities given to it in the *National Transportation Act, 1987*, the Agency has initiated several activities:

- The Agency issued several individual orders to improve access after complaints were lodged.[11]
- The Agency reported on May 27, 1991 on an inquiry into the policies of Canadian air carriers regarding people with disabilities.[12] The inquiry found that one airline had a policy of not accepting travellers with certain disabilities on specific aircraft and asked the airline to comment on the inquiry's finding that this policy may constitute an "undue obstacle to the mobility of disabled persons."

  In general, the inquiry found that the policies of large carriers do not appear to pose major problems to passengers with disabilities. It noted, however, that these policies are discretionary and subject to change by the companies without notice, and could lead to obstacles to the mobility of travellers. The inquiry suggested that future obstacles could be avoided if an overall policy with uniform terms and conditions for all air companies were put in place.

- The Agency announced an inquiry on March 19, 1991 into the accessibility of ferry services under federal jurisdiction. This inquiry is expected to recommend regulations that remove barriers to mobility that arise from the construction or design of ferry equipment and terminals, operating policies, training of ferry staff and communication of information to people with disabilities. The inquiry issued its interim report on January 17, 1992, and requested further comments, suggestions or new information from ferry operators and other interested parties.[13]
- Another inquiry is examining the accessibility of Canada's interprovincial bus system. This inquiry, which commenced in the spring of 1992 and includes public hearings in centres across the country, will report to the Minister of Transport in the spring of 1993.[14]
- On March 21, 1992, the Agency published its proposed regulations in two areas.[15] The first area covers the services to be provided to people with disabilities travelling in airplanes with 30 or more passenger seats. The second area discusses the training to be provided to personnel employed by all federally regulated carriers and terminal operators to enable staff to assist travellers with disabilities in the most appropriate ways.

## Recent Legislative Initiatives

On May 5, 1992, the Secretary of State tabled Bill C-78, which was aimed at improving accessibility to various services for people with disabilities by amending six Acts. The Acts are the *Canada Elections Act*, the *Access to Information Act*, the *Privacy Act*, the *Criminal Code*, the *Citizenship Act* and the *National Transportation Act, 1987*.

The bill was passed on June 18, 1992. The preamble to the *National Transportation Act, 1987* (NTA, 1987) now includes access for people with disabilities as part of the overall objectives for Canada's transportation system.[16]

In the news release announcing the tabling of the Bill, the Secretary of State noted that the NTA, 1987 amendment was in addition to the recent pre-publication of two sets of regulations to improve access to the federally regulated transportation system. He announced that "Additional CDRC [Canadian Disability Rights Council] proposals for improving transportation accessibility will be considered as part of an independent review of the *National Transportation Act, 1987* to be completed next year."[17]

The Secretary of State also indicated that Treasury Board will strengthen and promote its policy regarding the way in which the federal government communicates with persons with disabilities. This should result in more information concerning government programs and services — including transportation services — becoming available in alternative formats such as braille, large print, computer-readable diskettes and TDDs (Telecommunications Devices for the Deaf).

### Federal Government Programs

The federal government has provided funding for demonstration projects, workshops, communications projects and research to improve accessibility for people with disabilities. In 1990, funding for these projects totalled $1.5 million. One major demonstration project for intercity busing was funded by Transport Canada and implemented through Canada Coach Lines between the Ontario cities of Kitchener, Cambridge, Hamilton, St. Catharines and Niagara Falls. Use of this service, however, was low.[18]

The National Strategy for the Integration of Persons with Disabilities, announced in the fall of 1991, provides $24.6 million over a five-year period to help carriers improve access to their vehicles, and to develop training programs that encourage employees of federally regulated carriers to develop more positive attitudes and practices towards people with disabilities.[19]

### Municipal, Provincial and Territorial Government Programs

Although municipal governments are not generally concerned with intercity transportation, we recognize that they play an important role in ensuring that people with disabilities are able to reach air, rail, bus and ferry terminals.

Accessible taxis and para-transit are generally the responsibility of municipal governments but are, in many instances, funded jointly with provincial governments. Although provincial governments have acted in various ways to improve access, most of their funding goes for para-transit services that provide specialized transportation, such as vans with wheelchair lifts, in urban areas.

Other provincial and territorial activities have included financial support for vehicle retrofits of hand controls and lifts, special parking permits, transportation assistance for people with disabilities in rural areas, and demonstrations of wheelchair-accessible taxis.

### Industry Initiatives

Canada's major scheduled airlines, their affiliates and other independent airlines have voluntarily put in place services to assist travellers with disabilities. These services include reduced fares for attendants on flights within North America; in-flight wheelchairs and oxygen; wheelchair-accessible washrooms on many aircraft; and a toll-free telephone number in Canada for those with a Telecommunications Device for the Deaf.

For people with disabilities, access to major ferry and rail services is generally easier than to intercity bus services. Many ferry, rail and major bus companies do not charge for an attendant accompanying a person with a disability.

## RECOMMENDATIONS

While governments and industry have taken steps to improve access to intercity passenger transportation for people with disabilities, still more must be done. We make the following recommendations so that the pace of improvement will increase.

## RIGHTS TO ACCESS

We firmly believe that the transportation independence of all Canadians is important. When people with disabilities have access to jobs and educational facilities, they have a better chance of becoming productive and participating citizens who add to the vitality and diversity of Canadian society.

Therefore, we **recommend** that:

**9.1 Governments establish a goal that all travellers in Canada have access to public transportation in a safe, reasonably comfortable and dignified fashion, irrespective of physical or mental ability.**

**9.2 The National Transportation Agency establish minimum national standards of passenger accessibility. As with other related initiatives, these should be developed in consultation with groups representing people with disabilities, carriers and operators of transportation infrastructure.**

## MAKING EQUIPMENT AND INFRASTRUCTURE ACCESSIBLE

We recognize that there are many obstacles to providing accessible transportation for people with disabilities. Currently, people with transportation-relevant disabilities form only 10 percent of Canada's adult population. Even though that percentage is expected to rise, the proportion of Canadians with disabilities who wish to travel will remain low compared with the rest of the population. As a result, their demand for specialized transportation services may never be enough to lead to the provision of these services on a purely market-driven basis. In addition, individual point-to-point services and modification of equipment and services to improve accessibility — especially for the few travellers with ambulatory disabilities — are expensive.

The range of physical abilities that should be considered when providing access to passenger transportation services has been expanding. We wish that all obstacles to accessible transportation could be removed immediately, but recognize that imposing costly, immediate requirements upon Canadian carriers could undermine their viability.

At present, it may be more practical for some modes to operate accessible services parallel to existing public transportation (for example, the para-transit bus services in some municipalities). We believe, however, that people with disabilities should be as fully integrated into Canadian life as possible, and that one system to handle all travellers should be the long-term goal.

We believe that improved accessibility can often be accomplished at modest additional cost, by changing operating rules, sensitizing carrier staff, improving the design of new equipment and infrastructure, and modifying existing equipment and infrastructure. Other changes, unfortunately, are more costly.

Therefore, we **recommend** that:

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**9.3 Carriers and providers of infrastructure begin now to ensure that their specifications for new equipment and infrastructure will provide people with disabilities with continuing improvements in accessibility to their services. They should also implement, where practicable, retrofitting programs for their equipment and infrastructure.**

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Implementing this recommendation will result in substantial improvements in access for most individuals who currently find intercity travel either difficult or impossible. In some cases, further efforts are needed to ensure that the technologies and operating procedures devised to assist travellers with disabilities are appropriate, yet cost-effective.

We want to ensure that regulations dealing with accessibility for people with disabilities lead to continuing improvements.

Therefore, we **recommend** that:

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**9.4 The *National Transportation Act, 1987* be amended to require that the National Transportation Agency take more active responsibility for ensuring that transportation services become more accessible to those with disabilities.**

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## CARRIER COSTS

Improving accessibility for travellers with disabilities will undeniably add costs to carrier operations, which will be passed on to all travellers. We considered how our recommendations for the treatment of travellers with disabilities would affect carriers' operations in a competitive market, and wanted to ensure that the modes do not face unforeseen costs in the short term.

Therefore, we **recommend** that:

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**9.5 The National Transportation Agency, in taking more active responsibility for ensuring that transportation services become more accessible to those with disabilities, give carriers and operators of transportation related infrastructure:**

**(a) the freedom to decide how best to meet performance standards, rather than giving them detailed directions on how accessibility is to be achieved; together with**

**(b) a reasonable period of time to improve accessibility to new equipment and to infrastructure.**

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## ATTENDANTS AND IDENTIFICATION CARDS

We are aware of the stress and frustration that people with disabilities often experience because of administrative obstacles when trying to obtain or use specialized services. Some carriers, for example, have required clients with disabilities to obtain documentation regarding their ability to travel before accepting them as passengers, and sometimes required that this documentation be shown before each trip. Other carriers have insisted that passengers with disabilities must travel with an attendant, even though the passenger did not feel that an attendant was needed. On the other hand, for some people with disabilities, safe and comfortable travel can only be achieved with the help of an attendant.[20]

Whatever the special needs or services required by people with disabilities, we feel that these should be determined privately, prior to the trip. Wherever possible, we would like to eliminate what are sometimes embarrassing discussions at check-in counters and other points of departure about special arrangements and services.

Government, industry and groups representing people with disabilities should develop a mechanism that allows travellers with permanent or long-term disabilities to eliminate the need for discussion and questioning on each travel occasion.

We recognize that the condition of an individual with a permanent disability is not necessarily stable and, in some cases, the requirement for an attendant could change. The mechanism created should allow for periodic reviews of some decisions. One way of handling decisions relating to the needs of travellers with disabilities could be through the use of coded identification cards.

Therefore, we **recommend** that:

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**9.6 Through consultation among groups representing people with disabilities, carrier associations and the National Transportation Agency, a mechanism such as a coded identification card system be devised that would indicate quickly to carrier personnel the kinds of services needed by each traveller with a disability, including whether or not the traveller requires an attendant for safety or other reasons.**

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Coded identification cards could:

- identify those travellers requiring assistance with such activities as boarding, eating and using the washroom;
- indicate whether a traveller requires an attendant on some or all types of trips;
- indicate whether the need for an attendant applies to one or more modes of transportation;
- identify those travellers who do not require an attendant, so that such passengers are not refused access because they are unaccompanied; and
- be valid for use on all carriers.

We recognize that there may be situations where a carrier requires that, for safety reasons, a person with a disability be accompanied by an attendant.

Therefore, we **recommend** that:

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**9.7 The National Transportation Agency be appointed as the referee to mediate quickly disputes over the need for an attendant. In situations that are difficult to decide, the safety of all travellers, including the traveller with the disability, should be given primary consideration.**

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**9.8 When the National Transportation Agency or the carrier concludes that, for safety reasons, an attendant is needed during a trip to assist an individual with a disability, the attendant's fare be borne by the carrier. Otherwise, the traveller should bear the cost. To ensure consistency, carriers should coordinate their policies in this area.**

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## TRAINING OF TRANSPORTATION PERSONNEL[21]

During our hearings and in the written submissions we received from groups representing people with disabilities, we were told many times how important the attitudes of transportation personnel were in their dealings with travellers with disabilities. We learned that negative and uncooperative attitudes often result from lack of knowledge, experience or training on the part of transportation staff.

Therefore, we **recommend** that:

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**9.9 Carriers ensure that personnel who are in a position to assist travellers with disabilities be trained to deal with such passengers with sensitivity and understanding.**

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## COMFORT

Travellers with disabilities need both access to transportation infrastructure and services and the ability to travel with comfort and dignity. We recognize that levels of comfort for travellers with disabilities may not be equal to those for travellers without disabilities, but we believe that carriers must show reasonable efforts to improve these levels.

## INTERCITY BUSES

We are concerned that intercity buses, which are provincially regulated, are not always as accessible as airplanes, trains and ferries, which are federally regulated. Differences exist among the provinces and territories in their efforts to improve transportation access. We want to see improved accessibility to this important mode of passenger transportation — and a reduction of the disparities across the country.

Therefore, we **recommend** that:

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**9.10 Provincial and territorial governments implement more-uniform and adequate minimum accessibility standards for intercity buses for travellers with disabilities, or, if that does not occur, the federal government take back its delegated responsibility for nationally applied accessibility standards in order to ensure more uniformity.**

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## COORDINATION OF EFFORTS

Various committees and groups provide a forum for the discussion of accessible transportation. The federal Minister's Advisory Committee on Accessible Transportation is composed of groups representing individuals with physical and mental disabilities as well as representatives from the transportation industry such as air and bus carrier associations, VIA Rail and Marine Atlantic Inc. The National Transportation Agency also has an equipment accessibility advisory committee, whose members include representatives of people with disabilities, and air, rail, bus and ferry carriers.

Over the next few years, a delicate balance must be struck. While it is in everyone's interest in the long term to improve the integration of people with disabilities into Canadian society, in the short term some changes can be implemented more quickly than others. In recognition of this, we believe that advisory committees, with members representing a broad spectrum of interests, will play a critical role in finding this balance. For instance, we recognize that improving accessibility to small vehicles may be more difficult or proportionately more costly than doing so with large ones. And yet we also do not want to undermine the development of a highly flexible system to meet the transportation needs of all Canadians (including those living in sparsely populated areas) by creating a bias against small vehicles such as minivans and small aircraft.

In addition, members of these committees can bring to the government's attention examples of where government policies and regulations in non-transportation areas impede improved accessibility to transportation. We believe that these advisory committees provide an important communications link in the development of accessible transportation for those with disabilities.

Therefore, we **recommend** that:

**9.11 Canadians with disabilities, governments, carriers and manufacturers actively use advisory and coordinating groups to ensure that new services, equipment and infrastructure adequately serve those for whom they are intended, and to ensure that Recommendations 9.1 to 9.10 are implemented.**

Access to passenger transportation will allow Canadians with disabilities to lead more independent and productive lives. We believe our recommendations will help ensure that access. When people with disabilities have more access to educational and vocational facilities, they will become more independent and productive. The Canadian economy will benefit and this will go a long way to offset society's expenditures on improvements. In other words, an investment in accessibility has good potential for return.

# ENDNOTES

1. The adult population includes people 15 years of age and over. People with transportation-relevant disabilities are those who, because of a physical or mental condition, cannot use one or more passenger transportation services, or experience more than average difficulty doing so. See Hickling Corporation, *Transportation for People with Disabilities: A Policy Review and Analysis,* a report prepared for the Royal Commission on National Passenger Transportation, RR-01, March 1991, p. 3.

2. These data are drawn from a survey carried out by Statistics Canada in 1986 and 1987 and reported in *The Health and Activity Limitation Survey. Highlights: Disabled Persons in Canada,* Catalogue No. 82-602, March 1990. The survey was repeated in 1991 and the data are being released in phases. Several questions were added to the transportation section of the questionnaire. These data are scheduled for release in the summer of 1993.

3. These data are also from Statistics Canada's *Health and Activity Limitation Survey* of 1986 and 1987. The 1991 survey data relating to the discussion of the size of the population with disabilities will be available in the fall of 1992.

4. As mentioned in our Interim Report, disability increases dramatically with age in the "over 65" category — that is, from 36.7 percent for those aged 65 to 74 years, to 53.6 percent for those aged 75 to 84, and to 82.1 percent for those over 85 years of age. See *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, April 1991), p. 114.

5. Section 3.(1) of the *National Transportation Act, 1987.* This is reprinted in Volume 2 of this report.

6. This responsibility is given in sections 63.1 to 63.3 of the *National Transportation Act, 1987.* The sections are reprinted in Volume 2 of this report.

7. Further details of the U.S. accessibility standards for persons with disabilities are noted in Volume 2 of this report.

8. Further details regarding these regulations may be found in Volume 2 of this report.

9. The relevant sections of the *Canadian Charter of Rights and Freedoms* and the *Canadian Human Rights Act* are reprinted in Volume 2 of this report.

10. Further details of the Agency's activities are included in Volume 2 of this report.

11. These agency orders are noted in Volume 2 of this report.

12. National Transportation Agency of Canada, *Communiqué,* May 27, 1991.

13. Kenneth A. Mozersky, Anne M. Hampel and Paul Lacoste, *Interim Report of the Inquiry into Level of Accessibility of Ferry Services* (Ottawa: National Transportation Agency of Canada, January 17, 1992).

14. National Passenger Transportation Agency of Canada, *Communiqué,* March 11, 1992.

15. *Canada Gazette,* Part I, March 21, 1992, pp. 706-24.

16. The preamble now reads as follows (addition in italics):

    3.(1). It is hereby declared that a safe, economic, efficient and adequate network of viable and effective transportation services *accessible to persons with disabilities* and making the best use of all available modes of transportation at the lowest total cost is essential to serve the transportation needs of shippers and travellers, *including persons with disabilities*, and to maintain the economic well-being and growth of Canada and its regions and that those objectives are most likely to be achieved when all carriers are able to compete, both within and among the various modes of transportation, under conditions ensuring that, having due regard to national policy and to legal and constitutional requirements. . . .

17. Secretary of State of Canada, news release 92-010, May 5, 1992.

18. The purpose of this demonstration project was to assess the demand for an accessible intercity bus service and the economics of such a service. During the first 21 months of the project, 242 trips were made by people with disabilities (an average of 12 trips per month). Of these trips, 97 percent were made by passengers in wheelchairs. Forty-one people with disabilities used the service but two individuals made 47 percent of all the trips. The number of trips taken by people with disabilities equalled approximately 0.04 percent of the total trips taken. Further details are provided in Volume 2 of this report.

19. Further details are provided in Volume 2 of this report.

20. The proposed National Transportation Agency regulations published on March 21, 1992, indicate that "an air carrier shall accept the determination made by or on behalf of a person that the person does not require any extraordinary service during a flight." In this case, however, "extraordinary service" means "any service related to a disability that is not required by [the regulations] to be provided by an air carrier or any service that is not normally provided by an air carrier."

21. On March 21, 1992, the National Transportation Agency published its proposed regulations on the training to be provided to personnel employed by carriers and transportation related premises and facilities to enable them to assist travellers with disabilities in more appropriate ways. These have not yet been put into effect.

# CHAPTER 10

# APPLYING THE PRINCIPLES TO CARRIERS: AN OVERVIEW

## INTRODUCTION

In previous chapters, we set out our principles and applied them to the providers of infrastructure and to governments, who are responsible for promoting environmental protection and transportation safety and for ensuring that the needs of people with disabilities are addressed. In this and the next four chapters, we apply our principles to the providers of passenger transportation services. In Chapters 11 to 14, we deal exclusively with public carriers — firms offering services to the public. We discuss the changes in federal and provincial/territorial policies that are necessary to achieve pressures for efficient performance. In addition, we set out transitional mechanisms for carriers requiring time to adjust to our principles. In this chapter, however, we also note the role of private carriers — individuals and firms that provide their own transportation using private cars and aircraft.

## PRIVATE CARRIERS

In Canada, private passenger carriers include the users of about 10 million cars, 3 million vans and light trucks, and 10,000 private aircraft.[1] In addition, passenger travel to points not served by road, mostly small islands and settlements along rivers and lakes, is provided by private boats.

Taxpayer expenditure for private boat passenger travel, as distinct from recreational boating, fishing and freight shipping, is not substantial. Operators usually know local waters well and require few navigational aids, and they pay fuel (mostly gasoline) tax. Taxpayer involvement with the private car and private plane is more important.

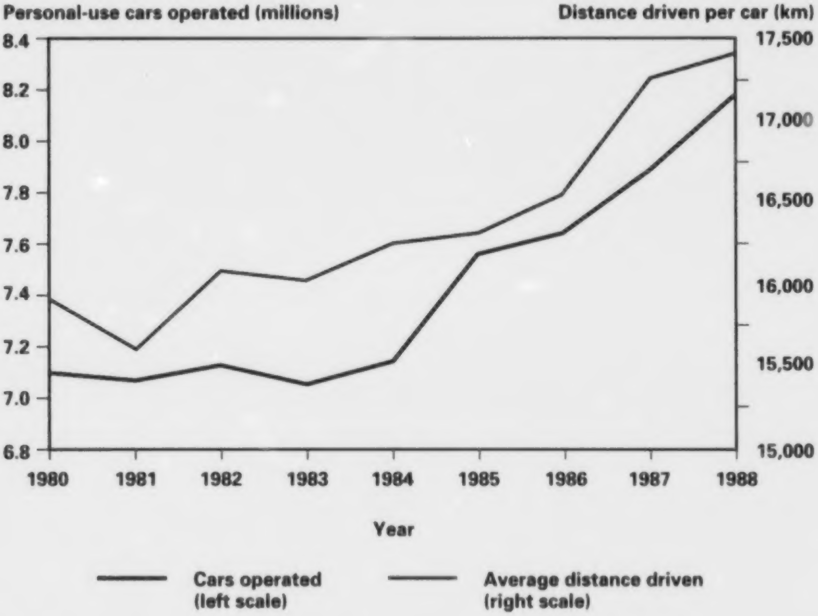
## TRAVEL BY PRIVATE CAR

Statistics show that the car is Canadians' preferred mode of intercity travel:

- in 1991, about 83 percent of all households owned one or more cars (including vans and light trucks), and 39 percent of all households owned two or more cars;
- in 1990, 68 percent of the population and 88 percent of the population 16 years of age and over, were licensed to drive;
- in 1990, household expenditures on cars for both urban and intercity purposes amounted to 84 percent of total personal expenditures on transportation, and about 11 percent of overall personal expenditures;
- in 1990, 91 percent of all domestic intercity round trips were by car;[2] and
- in 1990, around 80 percent of all domestic intercity kilometres travelled were by car.[3]

Chart 10-1 shows that both the number of cars and the use of these cars — as measured by estimates of average kilometres driven — increased between 1980 and 1988. (The data on which the chart is based are restricted to personal-use cars — not including personal-use vans and light trucks. The trends shown, however, are believed to be representative for "cars" as the term is used in this report.) Some transportation observers believe that public transit and electric vehicles will become increasingly attractive means of travel within cities. While this development could reduce the popularity of the car and its importance in intercity travel, current evidence indicates that the dominant position of car travel is increasing, rather than diminishing.

*Chart 10-1*
*Average Distance Driven, by Personal-Use Passenger Cars, 1980–1988*



**Sources:** 1980–Third Quarter 1983: Statistics Canada, *Fuel Consumption Survey*, Catalogue No. 53-226, December 1987; Fourth Quarter 1983: Statistics Canada, *Passenger Car Fuel Consumption Survey*, October 1984; 1984–1988: Statistics Canada, *Fuel Consumption Survey*, Catalogue No. 53-226, February 1990, summary tables in Parts 1–5.

**Note:** This chart shows data for personal-use cars, rather than for cars, vans and light trucks in all private uses. In general, the text refers to data on the latter basis.

Under our principles, each traveller should pay the full cost of his or her travel, and travellers, in total, should pay the full cost of the passenger transportation system, including those costs related to safety, accidents and protecting the environment.

Therefore, car users should pay for the costs they impose on roads, the health system and the environment. The proposed system of charges will require:

- adjusting licence fees and fuel charges so that road users pay for all road costs;

- introducing charges that pass on to car users the costs that the health care system and provincial/territorial systems of vehicle safety regulation and enforcement incur on their behalf; and
- increasing emission controls and charges in order to reduce vehicle pollution and to pass on to car users the costs of any remaining environmental damage they cause.

When car users pay the full costs of their travel, they will be more sensitive to the way their travel affects health care and the environment. Since cars form a major part of the passenger transportation system, changes in car travel and purchasing behaviour, based on an appreciation of the true costs of car use, will contribute substantially to the efficiency of the passenger transportation system.

## TRAVEL BY PRIVATE AIRPLANE

It is estimated there are 10,000 registered and active private aircraft in Canada. They fly an average of 80 hours a year. Apart from being limited to a small number of landing slots at the busy Vancouver and Toronto airports, private aircraft do use the public services designed for the aviation industry.

There are some 32,000 holders of private pilot licences in Canada. These licences are renewable without fee every one or two years, depending on the age of the pilot, and subject to medical examination.

Private aircraft, by virtue of provisions in the federal fee schedules, pay only a small portion of the costs of aviation services. With the exception of Vancouver and Toronto international airports, piston aircraft — and 98 percent of private aircraft are piston driven — pay no landing fees; instead, at federal airports they pay a per-litre fuel concession fee. The annual revenue from this 5¢-per-litre charge is about $2 million and is the only air infrastructure charge levied on private aircraft. This charge can easily be avoided by confining fuel purchasing to non-federal airports.

Private aircraft pay no terminal building fees because this fee schedule exempts aircraft with fewer than 10 seats. Private aircraft also do not pay the Air Transportation Tax, because the tax is applied to the selling price of a passenger's airline ticket. The Air Transportation Tax is used in substantial part to cover the costs of the local/tower aircraft control and enroute air navigation systems. About 95 percent of private aircraft use towered airports and more than 90 percent of private aircraft use different enroute navigation services from those used by the commercial airlines.

The level and structure of charges to private aircraft clearly require revision. Private aircraft operators, like all other users of the transportation system, should pay for what they get.

The changes in the charging systems for use of airports and of air navigation and traffic control systems, which we recommended in Chapter 5, will increase charges to private aircraft operators if they continue to use the air navigation and traffic control services currently provided.

## PUBLIC CARRIERS

In Chapters 5 to 9, we examined public and private carriers' use of transportation infrastructure, the responsiveness of their services to the needs of people with disabilities, and the environmental and accident costs of their transportation activities. In Chapters 11 to 14, we apply our principles to the operations of public carriers (airplane, train, bus and ferry) and examine major policy issues that arise regarding direct subsidies to carriers, economic deregulation and government ownership. The remainder of this chapter provides an overview of the issues to be discussed in Chapters 11 to 14. These chapters concentrate on issues of particular importance to the mode in question. We reiterate, however, that the principles for carriers (stated in Chapter 4) apply to all modes.

In this report, we are examining the conditions necessary to achieve a transportation system that is fair and efficient and meets appropriate standards of safety and environmental protection. The first condition is that all travellers, whether using public or private carriers, pay the true costs of their activities. The second is that public carriers face market pressures to respond to consumer preferences and to reduce costs, improve efficiency, and pass the resulting savings on to travellers.

Our aim of creating a truly competitive environment for intercity passenger transportation is consistent with the principle of the *National Transportation Act, 1987,* that "all carriers [be] able to compete both within and among the various modes of transportation."

In Chapter 4, we emphasized the importance of a competitive environment for public carriers and the need to:

- allow anyone who is "fit, willing and able" an opportunity to supply passenger carrier services;
- provide all carriers who are willing to pay their share of the costs with equal access to infrastructure; and
- permit carriers to withdraw their services, without undue delay, subject to adequate notice.

## "FIT, WILLING AND ABLE"

When we recommend that operators be "fit, willing and able" before entry to Canada's public passenger transportation industry, for the most part, we are not specific as to the appropriate screening criteria. In general we have in mind any operator who complies with safety regulations and has proof of adequate insurance coverage.

In the Canadian air passenger industry, except in the North, market entry regulation is restricted to fit, willing and able criteria. Under the *National Transportation Act, 1987,* in domestic service, an applicant must:

- meet Canadian ownership and control requirements;
- hold a Canadian aviation document in respect of the service to be provided — issued after the technical qualifications of the key personnel are established; and
- have prescribed liability insurance coverage or evidence of such insurability.

Here, we note the implications of the Commission of Inquiry into the Air Ontario Crash at Dryden, Ontario — that both fitness and ability should be monitored on an ongoing basis, and not be simply requirements that must be (temporarily) satisfied when the licence is first obtained.

Under the *Railway Act*, incorporation of a company that wishes to construct or operate a railway in federal jurisdiction using new track must prove "public convenience and necessity," including:

- economic feasibility;
- financial responsibility; and
- public interest.

If the company proposes to operate over existing tracks, it is subject to "fit, willing and able" criteria that are also applied by the National Transportation Agency.

Under the *NTA, 1987*, however, a candidate passenger rail operator does not enjoy the rights of track access that apply to freight railways. We addressed this constraint on entry in Chapter 6. Of course, the presence of a heavily subsidized Crown carrier in Canada's passenger rail sector restricts the practicality of entry by others.

Entry into Canada's intercity scheduled bus industry, which is tightly regulated under public convenience and necessity criteria, is much more restrictive than the "fit, willing and able" approach would be.

Passenger ferries in Canada are not subject to restrictive economic regulation. As for all operations in Canadian waters, safety regulation under the Canadian Coast Guard includes vessel design and maintenance, and the certification of ship's officers (vessels of more than 5 gross tons require a certified master). Use of harbours and ports is subject to approval of the local authority. Imported vessels are subject to import duties (which are sometimes waived). Crown carriers dominate both the west and east coasts, and some provincially funded ferry services are provided without charge. Under such circumstances, freedom of entry does little to enhance competition.

A competitive environment is not possible where there are barriers to market entry and exit, or where government subsidies give an advantage to particular carriers or modes. For example, the carrier costs of passenger rail and ferry operators are heavily subsidized. The result is that market prices do not accurately reflect costs. In addition, such subsidies cushion passenger rail and ferry operators from the market pressures to achieve cost efficiency.

## AIR CARRIERS

For more than a decade, federal policies have been aimed at expanding the role of market forces in the airline industry. The *National Transportation Act, 1987* clearly states that market forces, rather than economic regulation, should govern the supply of air services. The NTA, 1987, however, did not remove restrictions on the foreign ownership of Canadian carriers, or on the activities of foreign-owned carriers in Canada. In addition, Air Canada and Canadian Airlines International are experiencing financial difficulties, and there are many changes taking place in the international airline industry.

In Chapter 11, we examine current government policies with respect to air travel and whether these policies protect travellers, given the major restructuring of this industry.

## RAIL CARRIERS

While there is little competition among passenger rail carriers in Canada, passenger rail does compete with other modes, particularly the bus and private car. The large contribution made by taxpayers to rail travel, however, distorts the passenger rail market. As we observed in Chapter 3 (Table 3-1), rail travellers pay, on average, only one quarter of the capital and operating costs of passenger rail service. This situation raises a number of questions, which we discuss in Chapter 12:

- Are there special considerations that apply to passenger rail service that may justify some departure from the objectives and principles we set out in Chapter 4?
- If it is desirable to eliminate the taxpayer contribution to passenger rail travel, what type of transition mechanisms are needed to give carriers and travellers a reasonable amount of time to adjust to non-subsidized operations?
- Is public ownership of passenger rail carriers desirable?
- If public ownership of passenger rail continues, what mechanisms are required to ensure that those responsible for operations are accountable for their performance?

## INTERCITY BUS CARRIERS

Intercity bus carriers in Canada are subject to provincial/territorial regulations covering pricing and entry to the market. The *National Transportation Act, 1987* did not apply to the bus industry, although it did initiate a process of regulatory reform in trucking — another industry subject to provincial/territorial economic regulation. While a few provinces, notably Alberta, New Brunswick and Prince Edward Island, have somewhat relaxed their regulations, most bus carriers operate in a more regulated market than most other transportation businesses in the economy.

We believe that it is time to critically examine the basis for the economic regulations on the intercity busing industry. In Chapter 13, we examine whether there are any special factors that distinguish this industry and that justify continued economic regulation, and, if not, what policy reforms are required.

## FERRIES

In ferries, as in passenger rail, travellers benefit from major direct taxpayer contributions to their travel on average, although — unlike passenger rail — some major ferry services come close to covering their costs. Ferry travellers cover, on average, about 60 percent of total costs, which is much higher than the 25 percent covered by rail travellers. If supply of, and demand for, ferry service solely influenced the price charged, fares would tend to be substantially higher and traffic somewhat lower.

As with other modes, we believe it is necessary to consider whether, and to what extent, taxpayers should bear some of the costs of travel by ferry passengers. It is also necessary to examine governments' relationship to the federal Crown corporation, Marine Atlantic (the main ferry operator on the east coast), and the provincial Crown corporation, BC Ferries (the main ferry operator on the west coast).

# ENDNOTES

1. See Notes to Chapter 2, Volume 2 of this report for discussion of estimate of size of private vehicle fleet.

2. This figure is based on Canadian Travel Survey data (Statistics Canada, Catalogue No. 87-504).

3. This figure is based on Royal Commission analysis (see Notes to Chapter 1 and Notes to Chapter 2, Volume 2 of this report). As noted in Chapters 1 and 2 of this report, there is a range of possible definitions of intercity travel.

# CHAPTER 11

# APPLYING THE PRINCIPLES TO AIR CARRIERS

## INTRODUCTION

In the airline industry, recent reforms have been very much in the spirit of our principles. The *National Transportation Act, 1987* largely completed the process of economic regulatory reform that began in the late 1970s for air carriers. The privatization of Air Canada during 1988 and 1989 further helped to level the playing field. As a private-sector enterprise, Air Canada now competes in the market in a similar way to other firms, neither benefiting from special preferences nor burdened by special constraints on routes or equipment.[1]

Canadian experience with the new air-carrier regulations is still limited. Some benefits are obvious, such as more flights. Poor financial performance of carriers in recent years, however, has raised concerns about the viability of the Canadian air carrier industry in the future.

## WHAT CANADIANS TOLD US

We heard opposing views on the impact of regulatory reforms in the airline industry. Some shared the position put forward in submissions by the major carriers that these reforms have been highly beneficial to Canadian travellers. For example, Canadian Airlines International Ltd. stated that "deregulation of the airline industry has resulted in greater efficiency, better service, lower prices, and balanced competition." The International Association of Machinists and Aerospace Workers, on the other hand, represented a different view: "Contrary to the promises of its proponents, transport deregulation in the United States increased concentration and lessened competition in all sectors. Our experience in Canada has closely followed the American example."

There were different responses to the issue of airline concentration. For example, proponents of the new reforms said that the industry, "after undergoing major structural changes brought on by deregulation, has finally found its equilibrium with two highly competitive national carriers which are both supported by equally competitive affiliated regional carriers" (Bernard Juteau, Air Alliance). It was emphasized to us, however, that "the survival of Canada's major carriers cannot be taken for granted" (Claude I. Taylor, Air Canada). At the same time, the Commercial Travellers' Association of Canada argued that the National Transportation Agency should promote "competition amongst airlines." Some interveners pointed to remote communities where traffic is insufficient to sustain service by more than one carrier.

The proposed open skies policy between the United States and Canada was another source of controversy. Under the current bilateral air agreement between Canada and the United States, scheduled air carriers can fly travellers only between their home country and designated destinations in the other country. They are not allowed the rights of cabotage; that is, to take on passengers within the foreign country and transport them to another destination in that country.

Some groups viewed open skies as an opportunity for improved air service between and within the two countries. Others were concerned that it would threaten the existence of Canada's major carriers. Some short-haul carriers are uncertain if they will be able to survive in an open skies environment. In addition, some warned that open skies could increase congestion and create more delays at airports.

## GOVERNMENT POLICIES OF THE PAST

Historically, Canadian air carriers did not operate under the same rules. The primary instrument of federal airline policy was the government-owned airline, Air Canada.[2] Protected against competition from private carriers, it was for many years the only Canadian transcontinental air carrier. It used the profits it earned on transcontinental and international routes to subsidize service to some smaller and more remote communities, and to comply with assorted government directives.

Canadian Pacific Airlines (CP Air) was allowed entry into the international market in 1948 and was awarded a transcontinental route in 1959 (one return flight per day), but these concessions did not allow the private carrier to become a serious competitive threat to Air Canada. Although the constraints limiting CP Air's activities on transcontinental routes were gradually relaxed after 1967, the government believed that there was a need to protect Air Canada from "undue competition."

The 1966 Regional Air Carrier Policy represented a further government effort to control the structure of the industry and to limit the degree of competition among carriers. It established one airline as the preferred carrier to provide local and regional service in each of the five regions of the country. To ensure that the regional carriers provided scheduled services that supplemented, but did not compete with, the services provided by the two national carriers, the federal air regulator was given authority to screen regional carrier purchases of aircraft. The strict regulatory policy was reasonably successful in establishing price equality between the high-cost and low-cost routes.[3]

In the late 1960s and 1970s, however, the government found it increasingly difficult to balance the demands from CP Air and the regional air carriers for less regulation with the desire to preserve Air Canada's historic role as an instrument of government policy.

This pressure coincided with public concerns about the accountability of federal Crown corporations. Of particular concern was the difficulty of monitoring the performance of Crown corporations such as Air Canada, which benefited from special concessions and were at the same time asked to meet vague objectives. The 1978 *Air Canada Act* attempted to eliminate this problem. Air Canada was now to "have due regard to sound business principles, and in particular the contemplation of profit." The following year, all constraints limiting CP Air's activities as a transcontinental carrier were removed.

The United States deregulated its airline industry in 1978, resulting in lower costs and increased service. Research in the United States, prior to 1978, had pointed to the high costs resulting from controls administered by the Civil Aeronautics Board (CAB). The studies showed that resources were being wasted because regulated prices gave carriers misleading signals about the type and quality of service to provide, and that airline costs and fares were substantially higher than they would be in an unregulated environment. In a fully competitive environment, high labour costs could not be passed on to consumers as easily as they could in a regulated market. Furthermore, an unregulated environment would give airline managers the freedom to structure their operations in the most efficient manner.

The results of deregulation in the United States generally confirmed these expectations. After the relaxation of price controls and the opening of entry, air service expanded considerably and average fares, adjusted for inflation, declined substantially under the pressure of intense carrier competition. Since the mid-1980s, a number of airline failures, acquisitions and mergers has resulted in a major restructuring of the industry. Notwithstanding the high degree of industry concentration, most airline markets are subject to competition. Recent studies found that consumers, overall, benefited substantially from deregulation — which has brought increased airline efficiency, air fares that better reflect airline costs, airline service to more locations, and more flights.[4]

After deregulation in the United States, pressures mounted to end economic regulation in Canada. The experience in the United States with deregulation highlighted the gains that a more competitive airline industry brought to consumers. In addition, deregulated U.S. carriers appeared to attract a significant share of Canadian business in some markets.[5]

Price competition in the Canadian market intensified in 1980 under the more liberal charter regulations introduced by the Canadian Transport Commission. In 1984, a new Canadian Air Policy eliminated the remnants of the Regional Air Carrier Policy, substantially eased the conditions of entry into airline markets in southern Canada, and gave carriers more freedom to set fares.

## CURRENT GOVERNMENT POLICIES

The *National Transportation Act, 1987* (NTA, 1987), which came into effect on January 1, 1988, states that "economic regulation of carriers and modes . . . will not unfairly limit the ability of any carrier or mode of transportation to compete freely with any other carrier or mode of transportation." The Act distinguishes between airline activity in southern and northern Canada.

Economic regulation of airline activity in southern Canada has been almost completely dismantled. To enter the market, a prospective carrier must simply establish that it can meet basic safety, insurance and Canadian-ownership requirements. Carriers do not require permission to exit from a market, although they must notify the National Transportation Agency 120 days in advance of their intention to reduce (to less than one flight per week) or eliminate a service that had been offered once a week or more for six months. Fares must be published, but they are not subject to regulation. There is, however, a provision that allows the public to appeal to the Agency about basic fare increases on monopoly routes. The Agency may disallow all or part of the increase if "there is no other alternative, effective, adequate and competitive transportation service," and if the increase is found to be "unreasonable." This provision, in respect to southern markets, has had, as yet, little use and no complaints have reached the formal investigation stage.

Airline activity in and to northern Canada is still subject to some economic regulation. Those objecting to the entry of a new carrier can challenge that entry, but the onus is on the opponents to demonstrate that entry would jeopardize the quality of existing services. Exit from a northern market is subject to the same advance-notice provisions as exist in southern Canada. Fares are also not regulated, but the provision for appeal is somewhat broader. Objectors may ask the Agency to investigate either an unreasonable basic fare increase or an unreasonable basic fare level. There have been a number of investigations of northern rates, but in none of these cases, since 1988, did the Agency find that the levels or increases were unreasonable.

Foreign ownership of Canadian air carriers is limited by law. The NTA, 1987 requires that at least 75 percent of the voting shares of Canadian air carriers be owned by Canadian residents, and that control of these airlines is held by Canadians.[6] In addition, ownership restrictions are incorporated in the legislation that provided for the privatization of both Air Canada and Pacific Western Airlines (PWA), the parent of CP Air, now Canadian Airlines International Ltd. The federal *Air Canada Public Participation Act* limits the holdings of any one person or group to 10 percent of voting shares, and the holdings and control of non-residents in aggregate to 25 percent of voting shares. The Alberta government's *Pacific Western Airlines Act* restricts the holdings of any one person or group to 10 percent of the voting shares, and since the *National Transportation Act, 1987* also applies to PWA, its foreign ownership and control are also restricted.[7]

## CHANGES UNDER ECONOMIC DEREGULATION

In the early 1980s, the main providers of air passenger service were:

- two transcontinental carriers — Air Canada and CP Air;
- four regional carriers — PWA, Nordair, Eastern Provincial Airways and Quebecair — that also provided scheduled jet service; and
- one charter carrier — Wardair.

In 1982, government-owned Air Canada earned two and a half times more revenue than CP Air and carried three times the number of passengers.

During the second half of the 1980s, there was a dramatic restructuring of the industry. PWA acquired CP Air in 1987 and gained control of those regional carriers that had already been absorbed into the CP Air system — Eastern Provincial Airways and Nordair. Canadian Airlines International Ltd., the new consolidated operation owned by PWA, acquired Wardair in 1989. Wardair, formerly a charter carrier, ran into financial difficulties shortly after its 1986 entry into the domestic market for scheduled service. Also in the 1980s, Air Canada acquired interests in a number of regional airlines — Air Ontario, Air BC, and NWT Air.

While these reorganizations were under way, the federal government was evaluating its own position as owner of Air Canada. By the early 1980s, the carefully designed system of cross subsidization was eroding, and it was difficult to distinguish Air Canada from private carriers. Air Canada was privatized by two share offerings — in September 1988 and July 1989.

Today, the airline industry is dominated by two large private-sector corporations, Air Canada and Canadian Airlines International (the "majors"). Both corporations have established feeder affiliates and integrated them into their operations. Integration has involved the coordination of flight timetables and the incorporation of the feeders into the baggage, reservation and frequent-flyer systems of the majors. Table 11-1 provides a snapshot of the two "airline families" as of the end of 1991.

The majors have similar shares of domestic traffic, although Air Canada continues to predominate in international markets. Independents and smaller commuter airlines not connected to the majors also provide scheduled service. In 1991, there were 288 level 1 to 4 air carriers (having annual gross revenues of $250,000 or more). Along with the majors and their affiliates, and independent scheduled carriers, level 1 to 4 carriers include charter carriers (for example, Nationair, Canada 3000 and Air Transat) that are an important source of competition on many major routes. Independent airlines enjoyed a period of growth in the 1980s, but a number of the more important independents (Intair, City Express) have failed. The majors' affiliates, however, have enjoyed strong growth as the majors have streamlined their operations and withdrawn from markets they could not profitably service with their large aircraft.

**Table 11-1**

**STRUCTURE OF THE AIRLINE "FAMILIES," 1991**

| Airline[a] | Points served | Percentage ownership by parent/ subsidiary | Fleet |
|---|---|---|---|
| Air Canada[b] | 48 | Parent | 115 jets |
| Air Nova | 16 | 100 | 5 jets; 9 non-jets |
| Air Alliance | 14 | 75 | 15 non-jets |
| Air Ontario | 10 | 75 | 21 non-jets |
| *Air BC* | 26 | 85 | 5 jets; 33 non-jets |
| Pacific Coastal Airlines | 9 | 50 | 18 non-jets |
| NWT Air[c] | 5 | 100 | 2 jets; 1 non-jet |
| PWA Corporation[d] | — | Parent | — |
| Canadian Airlines International[e] | 42 | 100 | 76 jets |
| *Canadian Regional Airlines*[f] | — | 100 | — |
| Inter-Canadien | 26 | 70 | 12 non-jets |
| Ontario Express | 25 | 100 | 26 non-jets |
| Calm Air | 22 | 45 | 8 non-jets |
| Time Air | 29 | 100 | 7 jets; 29 non-jets |
| Air Atlantic[g] | 19 | 45 | 3 jets; 13 non-jets |

Source: National Transportation Agency, *Anual Review 1991*, pp. 22-23.

a. Parent companies appear in white type. Firms indented once are owned by the parent. Firms indented twice are owned by the preceding firm in italics.

b. In April 1991, Air Canada established Air Canada Regional Airline Holdings to manage its regional carrier interests.

c. NWT Air has code-sharing agreements with five affiliated carriers (which serve 21 points).

d. PWA Corporation is a holding company and thus does not operate its own services.

e. Canadian Airlines International includes the division Canadian North, which serves 23 additional destinations in the Northwest Territories, Quebec, Manitoba, and Alberta using 8 jets.

f. Canadian Regional Airlines is a management company and therefore does not operate its own services.

g. Air Atlantic is 45 percent owned by PWA Corp., but is managed by Canadian Regional Airlines.

Under deregulation, the hub-and-spoke system replaced some direct flights. Passengers from various cities increasingly travel by spoke routes into a centralized airport — the hub — from which they take connecting flights to their destination. Hubbing consolidates traffic at a central location, allowing airlines to put more passengers on each flight. Pooling of passengers also allows airlines to provide more flights to more locations than would be possible under the alternative point-to-point system.

To take advantage of the economies of hubbing, airlines require sophisticated scheduling and passenger handling systems that enable them to move a number of aircraft through a connecting point at about the same time. A successful hubbing system also requires a large network, so that incoming flights can provide the passengers needed to achieve large passenger loads on departing flights.

The economies to be realized from a hub-and-spoke system are fewer in Canada, where the population is concentrated along the Canada–United States border, than in the United States, where the population is more dispersed. Nonetheless, the realignment of flight patterns and the integration of operations in each carrier family have supported the development of some hub-and-spoke systems in Canada.

Changes in traffic patterns have had a major impact on Canadian airports. Lester B. Pearson International Airport in Toronto, which has become Canada's major hub, experienced a 58 percent (7.9 percent average annual growth rate) increase in commercial aircraft movements between 1984 and 1990.

Similarly, Vancouver and Halifax, which emerged as important regional hubs, have also experienced greater air traffic. Hubbing results in increased demands on both air and ground facilities of an airport. At Pearson, the completion of Terminal 3 has helped the airport cope with the increase in ground traffic but, to alleviate the pressure from the growth in air traffic, air movements have been capped. The cap is 82 air movements per hour as of July 1992, up from 76. There are plans to increase the number of air traffic controllers and to expand runway capacity at Pearson, as well as at Vancouver.

## AIRLINE PERFORMANCE UNDER ECONOMIC DEREGULATION

### PRICES AND COSTS

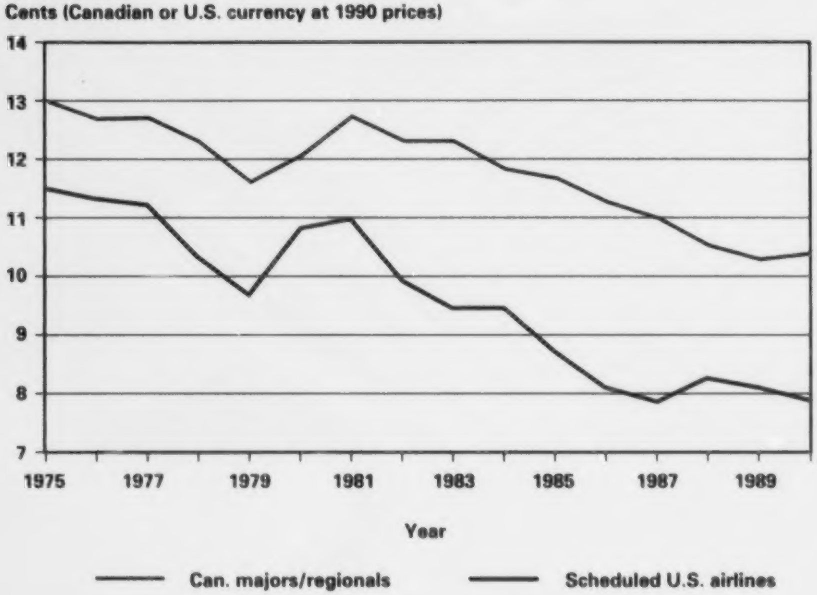
Average air fares, adjusted for inflation, have fallen in Canada during the past decade, as shown by airline yield, which is calculated by dividing passenger revenue by passenger-kilometres. This decline (Chart 11-1) is the result of several factors: a restructuring in rates due to market pressures, which led to an elimination of the cross subsidy from long-haul to short-haul flights; an increase in long-haul flights; and an increase in the importance of discount fares (Chart 11-2).

Since regulatory reforms were introduced, air fares have come to more closely reflect airline costs. Travellers flying long distances pay less per kilometre than passengers on short-distance flights because some airline costs do not increase with distance. Costs per passenger-kilometre are also lower if an airline can spread its fixed costs over more passengers by using larger airplanes and achieving higher load factors. This benefits passengers flying on high-density routes as compared with those flying between small centres.

Discount fares are more important in some markets than in others. The proportion of travellers flying on discount fares is high in long-haul, trans-border and international markets, where competition is intense. Discount fares are also more important on flights with a high proportion of leisure (as distinct from business) travellers. Discounting is an important component of the major airlines' yield management systems.[8] Airlines have become adept at fine-tuning their use of discount fares (adjusting their number, the size of the discount and the restrictions applying to their use) so as to increase passenger loads and maximize flight revenue.

*Chart 11-1*

*REVENUE YIELDS PER PASSENGER-KILOMETRE, MAJOR CANADIAN AND U.S. AIRLINES, 1975–1990*



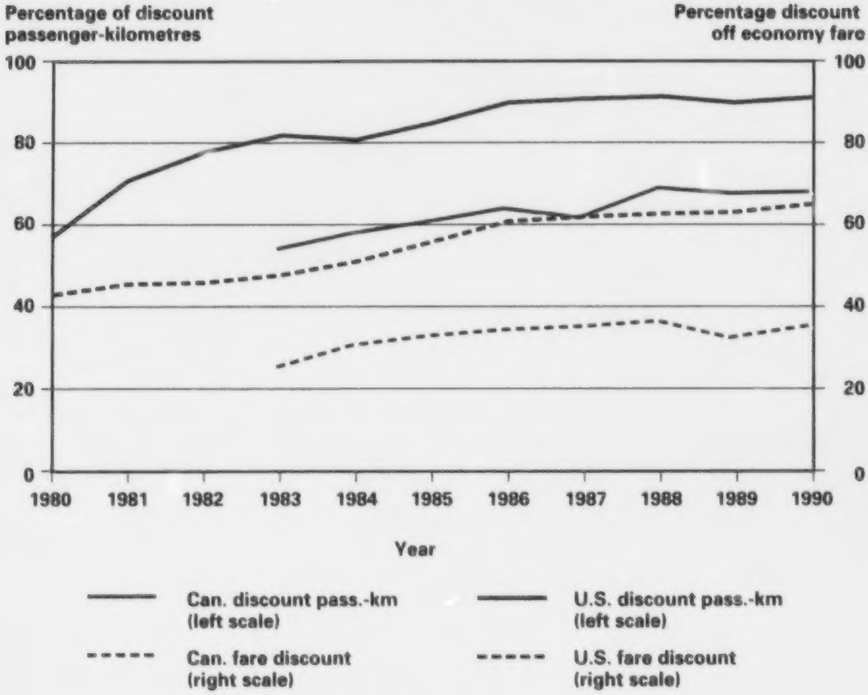
Sources: Canada: unit-toll passenger revenue data are from Statistics Canada, *Air Carrier Financial Statements/Canadian Civil Aviation*, Catalogue No. 51-206, 1975–1990 editions; passenger-kilometre data are from Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, October-December issues, 1975–1981 and Catalogue No. 51-206, 1982–1990. Data on the Consumer Price Index for all items are from Statistics Canada, CANSIM, matrix 1922.

United States: all data are from Air Transport Association of America, *Air Transport: The Annual Report of the Scheduled Airline Industry* (Washington: ATA of America), 1986 and 1991 issues. The U.S. consumer price index is taken from *Economic Report of the President* (Washington: U.S. Government Printing Office, 1991), Table B-60.

Notes: Canadian data refer to unit-toll services of Level 1 and Level 2 carriers for 1975–1981 and of Level 1 carriers for 1982–1990. Unit-toll passenger revenues were unavailable for 1982–1986 but yield data were provided in Table 1 of the 1987 edition of *Canadian Civil Aviation*.

Nominal yields are deflated by the Consumer Price Index for all items, which has been re-based to 1990 = 100.

*Chart 11-2*
*The Extent of Domestic Discount Air Fares in Canada and the United States, 1980–1990*



**Sources: Canada: The percentage of discount passenger-kilometres for 1983–1989 is from L. Di Piétro and G. Baldwin, "Discount Air Fares in Canada: Price Competition and Price Differentiation," in *Proceedings of the 26th Annual Meeting of the Canadian Transportation Research Forum*, May 28 to 31, 1991, p. 517; 1990 data are from Statistics Canada, *Canadian Civil Aviation 1990*, Catalogue No. 51-206, November 1991, Table 6.3, p. 31. The percentage discount off the economy fare is taken from Table 2 of the first source mentioned and from unpublished data from Statistics Canada's Fare Basis Survey.**

**United States: Air Transportation Association of America, *Air Transport: The Annual Report of the Scheduled Airline Industry* (Washington: ATA of America), various issues.**

In the United States, the decline in air fares after 1978 was made possible, in part, by the ability of the airlines to exercise greater control over their labour costs. This involved tough negotiations both to reduce wage and salary expectations of airline employees, and to eliminate those work practices that were lowering productivity. The impact of deregulation on labour markets has been less pronounced in Canada.

Increases in productivity, however, have helped to restrain labour costs. The productivity of airline workers has increased at an impressive rate during the past decade (Chart 11-3). While part of this increase must be attributed to technological improvements, also important was the lifting of economic restrictions on the activities of Canadian carriers.[9]

## QUALITY OF SERVICE

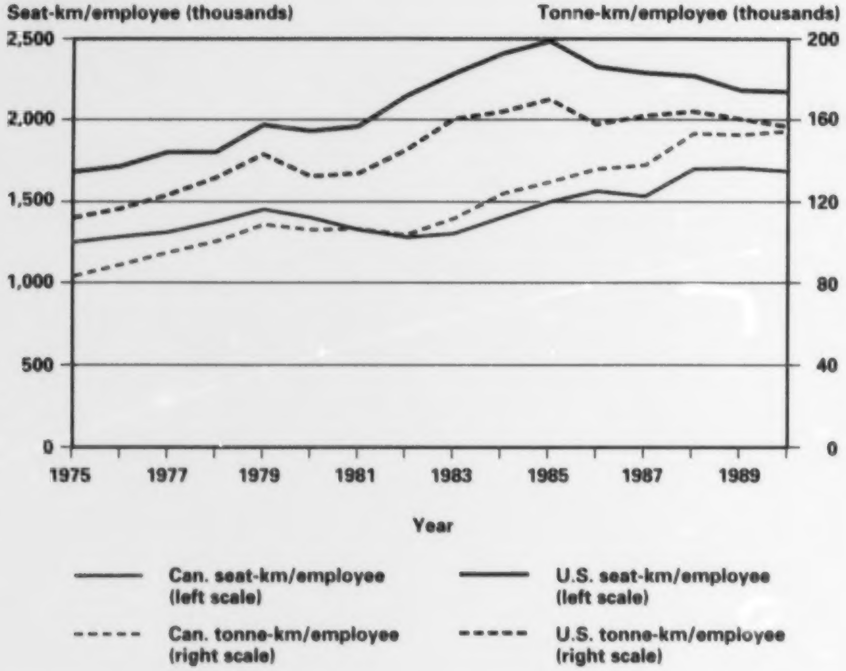
Under deregulation, carriers have the flexibility to customize services. They can provide a no-frills service for passengers who want low fares, while offering a premium service for passengers who value booking freedom and in-flight amenities.

As a result of the organizational and routing changes that have occurred under deregulation, some short-haul regional routes once served by jet aircraft are now being served by turboprop aircraft operated by an affiliate of one of the major airlines. In addition, some passengers who had been able to fly directly to their destination under the point-to-point routing system must now make connections through a hub airport. While connecting and indirect (same plane, one or more stops) services have increased, there has also been a net increase in the number of direct (non-stop) services.

Travellers now benefit from a greater choice of flights. Air services have expanded as more and more communities have become tied to one or more hub-and-spoke networks. The number of Canadian cities and towns with scheduled air service rose by approximately 60 percent between 1983 and 1990. Flight frequency also increased substantially during this period. In Canada's top 25 city-pairs, there were 51 percent more flights in 1991 than in 1983, while available seats increased by 20 percent. Researchers in the United States have

Chart 11-3

PRODUCTIVITY INDICATORS, MAJOR CANADIAN AND U.S. SCHEDULED AIRLINES, 1975–1990



**Sources:** Canada: Available seat-kilometres for 1975–1980 are from Statistics Canada, *Transcontinental and Regional Air Carrier Operations*, Catalogue No. 51-001, December issues; for 1981–1986, data are from Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, October-December issues, Table 4; for 1987–1990, data are from Statistics Canada, *Canadian Civil Aviation*, Catalogue No. 51-206, 1988–1990 issues, Table 2.3.

Total tonne-kilometres for 1975–1981 are obtained from Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, October-December issues; data for 1982–1990 are from Statistics Canada, *Canadian Civil Aviation*, Catalogue No. 51-206, 1982–1990 issues.

Employee statistics for 1975–1987 are from Catalogue No. 51-002; for 1988–1990, Catalogue No. 51-206, Table 4.2.

United States: Air Transport Association of America, *Air Transport: The Annual Report of the Scheduled Airline Industry* (Washington: ATA of America), various issues.

**Notes:** Canadian data refer to unit-toll services of Level 1 and Level 2 carriers for 1975–1981 and of Level 1 carriers for 1982–1990.

Seat-kilometres for regular, irregular and specific point service were estimated for 1975–1986 by applying the average load factor on scheduled services of the regional airlines. Nordair's seat-kilometres were unavailable for 1983 and 1984 and were estimated using the above method.

Tonne-kilometre statistics include both passenger and freight weights.

found that because travellers, especially business travellers, place a high value on finding flights that correspond to desired departure times, the increase in numbers of flights is one of the most important benefits of deregulation. Surveys conducted by the National Transportation Agency confirm the importance of convenient departure and arrival times to Canadian business travellers.

Air service to northern and remote communities has also increased. Regional affiliates established their own local connections to serve these markets. The result is more frequent service and links that allow travellers in these communities to connect with the country's main airline networks. The number of weekly scheduled direct flights increased by 163 percent on 60 northern air routes monitored by the National Transportation Agency between 1983 and 1991, and the number of scheduled indirect flights (same plane, one or more stops) increased by 61 percent.

There is no evidence that deregulation has lowered airline safety. Economic deregulation did not extend to safety regulation. In Canada, as in the United States, the federal government continues to set and enforce standards for safe airline operation. Opponents of deregulation believed that airlines would cut back on safety precautions because of the pressure to reduce costs and become more competitive. As we discuss more fully in Chapter 8, it is difficult to separate the effects of economic deregulation from all the other influences on air safety. Nevertheless, there is no evidence in the overall statistics on air accidents, in either Canada or the United States, that deregulation has lowered safety levels.

## MARKET STRUCTURE AND COMPETITION

In both Canada and the United States, the airline industries have become highly concentrated. In the United States, low-cost, innovative airlines that provided an important competitive stimulus in the early years of deregulation have disappeared. Today, three airlines — Delta, American and United — control more than half the market. In

Canada, the airline industry is controlled by two airlines. Air Canada and Canadian Airlines International and their networks account for approximately 95 percent of the revenue for scheduled services and 90 percent of total industry revenue. Are competitive forces in the market sufficient to impose pressure on carriers to increase efficiency and to pass on the resulting gains to consumers?

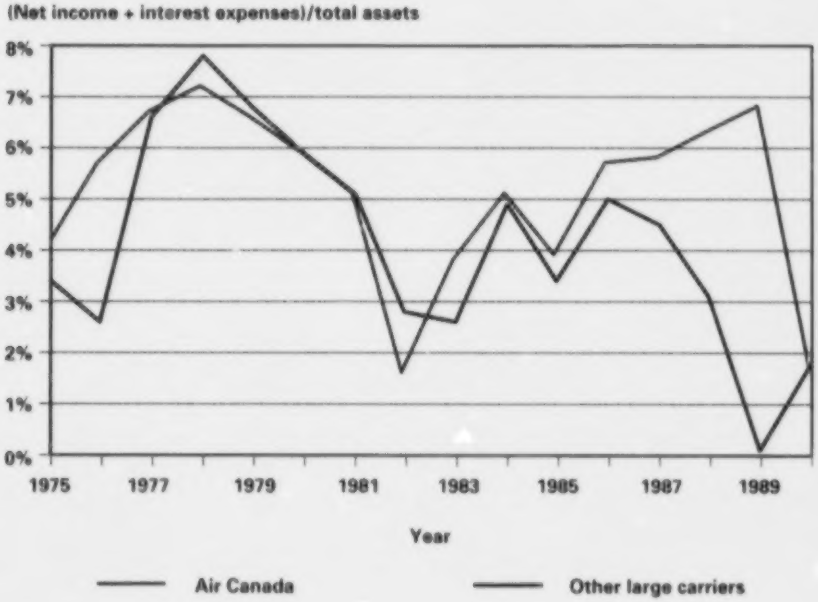
Studies of city-pair markets suggest that there has been an increase in competition. The development of the Canadian Airlines International network overcame the market imbalance that previously existed because of the dominance of Air Canada. In 1983, one carrier alone served about 20 percent of the largest communities in the country. By 1991, the two major carriers served all 43 of the largest communities that account for over 95 percent of originating and terminating traffic. Independent carriers provided scheduled service in 30 of these communities.

Consolidation in the Canadian air carrier industry, however, may not yet be over. Several charter and independent airlines have left the industry or become part of the majors' families. For example, Wardair was taken over by Pacific Western Airlines (PWA) in 1989. Intair, the largest independent, filed for bankruptcy, and its turboprop operations in Quebec were acquired by PWA in 1991.

The recent financial performance of Air Canada and Canadian Airlines International has been unimpressive (Chart 11-4). Their lower revenues are a result of several factors, including the recent economic slowdown in Canada and other countries, and the heavy debt load and high interest expenses from the purchase of $6 billion worth of aircraft since 1986. In addition, with the privatization of Air Canada and with PWA's acquisition of Wardair, both majors have had to undertake considerable re-organization.

Markets with at least two competing carriers enjoy lower fares. In the United States, it is difficult for new airlines to enter fortress hubs — those dominated by one carrier. For air travellers who cannot bypass

*Chart 11-4*
RATES OF RETURN ON INVESTMENTS FOR MAJOR CANADIAN AIRLINES, 1975–1990



**Source:** Statistics Canada, *Air Carrier Financial Statements/Canadian Civil Aviation*, Catalogue No. 51-206, 1975–1990 editions.

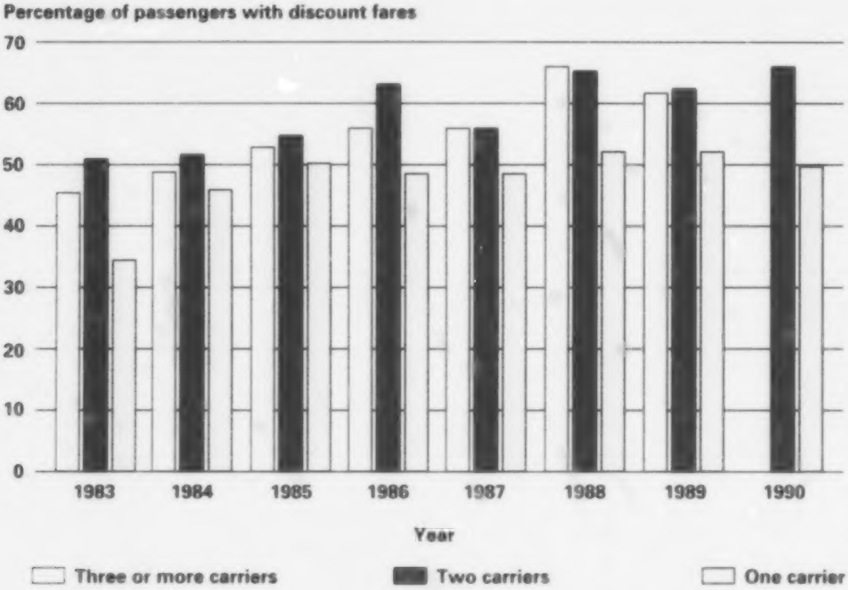
**Note:** Other large carriers include CP Air, the major regional carriers and Wardair for 1975–1986 and Canadian Airlines International Ltd./Wardair thereafter.

these hubs, fares have been higher than for other travellers. In Canada, fares are higher in city-pair markets served by only one carrier, although these markets account for a small percentage of total traffic. Chart 11-5 shows that the proportion of travellers obtaining discount fares is somewhat lower in city-pair markets served by only one carrier. Chart 11-6 shows that large discounts are more common in city-pair markets served by two carriers than those served by one carrier.

Experience under deregulation has shown that the majors and their affiliates have a number of advantages over potential new entrants. Their large and well-integrated networks allow them to satisfy most

Chart 11-5

PASSENGERS TRAVELLING ON DISCOUNT FARES, BY NUMBER OF CARRIERS SERVING CITY-PAIRS, 1983–1990



**Source:** Unpublished data from Statistics Canada's Fare Basis Survey.

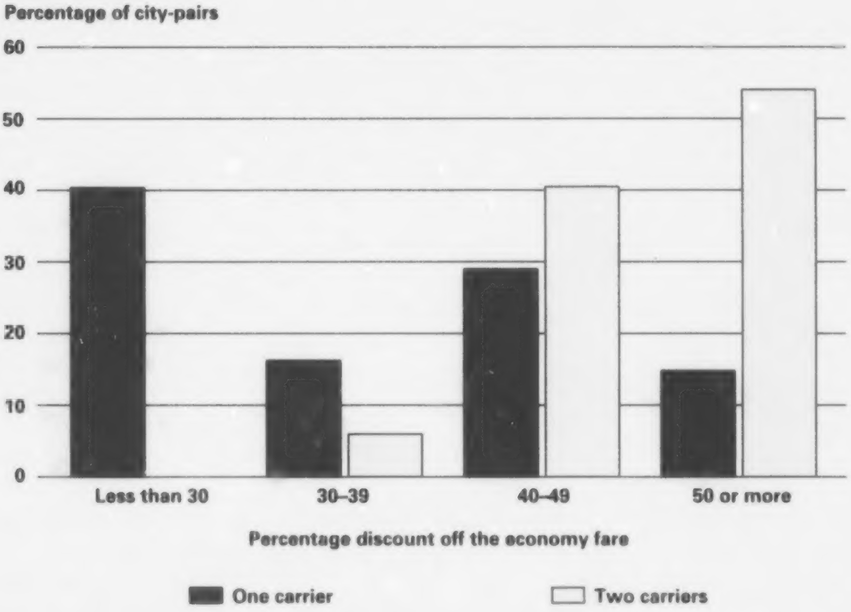
**Note:** Only Air Canada and Canadian Airlines International Ltd. were included in the survey for 1990.

travellers' preferences for single-line service from origin to destination. Marketing innovations, particularly computer reservation systems (CRSs), but also frequent-flyer programs (FFPs) and various travel agent incentives, have also reinforced the strong position of the majors. Large carriers also have deeper pockets, and are therefore in a better position than a smaller rival to sustain the losses that sometimes result from a competitive battle. There is a debate as to whether large airlines have cost advantages over smaller airlines. It seems clear, however, that a high-volume route has lower costs than a low-volume one.

The extent of the majors' networks may make it difficult for a new airline to enter the market. Air Canada and Canadian Airlines International have been successful in bringing most feeder carriers

*Chart 11-6*

*PERCENTAGE DISCOUNT OFF ECONOMY FARE, BY NUMBER OF CARRIERS SERVING CITY-PAIRS, 1990*



**Source: Unpublished data from Statistics Canada's Fare Basis Survey.**

**Note: Only Air Canada and Canadian Airlines International Ltd. were included in the survey for 1990.**

into their networks. A potential carrier could have difficulty establishing itself if it could not gain access to feeder traffic. The relevant authorities must ensure that restrictive agreements between the majors and their feeders have not created a barrier preventing entry of a new carrier.

Reservations systems could also give the majors an advantage over new airlines. Air Canada and Canadian Airlines International jointly own the Gemini Computer Reservation System, which, in 1989, accounted for 82 percent of air segments (a segment being one takeoff and landing) booked in Canada. Participation in a CRS has become a necessity for airlines. Without some public monitoring, Air Canada and Canadian Airlines International could use their control of the dominant CRS system in Canada to put their potential rivals at a disadvantage.

Canada's *Competition Act* has provided a basis for addressing both the potential anti-competitive effects of CRSs and the general problem of exclusive contracts and "refusal to supply."[10] The Canadian Competition Tribunal issued rules to govern the conduct of the Gemini CRS, and an interdepartmental government committee is developing permanent regulations to be administered and enforced by the National Transportation Agency. These safeguards are adequate and appropriate.

We are firmly convinced that Canadian air travellers are better off as a result of economic regulatory reforms. Problems certainly exist under deregulation, but these should be put into perspective. Airline markets may be imperfect today, but they were even more imperfect in the past, when they were controlled by rigid economic regulations. We believe that a number of measures are available to assist in achieving the benefits of competition or to respond should competition decrease. These measures involve different elements of international air policy, to which we now turn.

## INTERNATIONAL AIR POLICY[11]

### BILATERAL AIR AGREEMENTS

International air markets are regulated through international agreements. Foreign carriers in Canada and Canadian carriers in international markets are subject to restrictions in their operations. Countries with their own domestic airlines generally do not allow foreign carriers to operate within their borders. Bilateral air agreements between countries provide a system for regulating entry and for controlling pricing, capacity, frequency and other matters in international markets. Canada's international air policy is governed by such agreements.

An objective of bilateral agreements is the sharing of air markets between the carriers of the countries involved. Moreover, the existence of bilateral air service agreements means that Canada cannot move unilaterally to deregulate international air services to and from Canada.

The international air market is tightly regulated. Canada takes part in about 60 international bilateral air agreements. Some include limits to the capacity (seats) that each country's designated airline can offer, and require both airlines to agree to any change. Some have restrictions on fares; again, the airlines must agree to the changes. The agreement with France concerning Martinique and the now-expired, experimental, trans-border agreement with the United States were the only agreements where tariff changes could be made rapidly in response to market shifts.

In agreements under which routes are operated solely by foreign carriers, Canada requires revenue sharing or other benefits to the Canadian carrier. Finally, two thirds of the agreements limit the ability of either country to designate more than one carrier on a route.

Bilateral air agreements assume that each country has at least one national airline. If there were no international Canadian air carrier, Canada would be forced to depend on foreign carriers for international airline service. The result could be a monopoly in markets to and from Canada if other countries were to assign a single national carrier to the route. For example, the Canada–France bilateral agreement allows Canadian air carriers to operate between Canada and France in competition with Air France, but does not permit Canada to designate a non-Canadian carrier for that route. In the absence of a Canadian carrier, the Canada–France market would become an Air France monopoly. Canada would have the option, however, of withdrawing from the bilateral agreement, but then Canadians wishing to travel to France would have to make their way to France via a third country.

In the context of the existing system of bilateral agreements, we want to examine the potential for Canada's international air policy to give Canadians access to competitive air services in international and domestic air markets. To achieve this, Canada requires two or more actual or potentially competing carriers operating between destinations within Canada, and between Canadian and foreign destinations.

## RECOMMENDATIONS

### OWNERSHIP AND CONTROL

Although there are no national restrictions on ownership for the other transportation modes, air carriers are protected from foreign ownership and control under the *National Transportation Act, 1987*. This protection is consistent with the Chicago Convention, which sets the requirements of the world's bilateral air agreements. Under the Chicago Convention, there must be substantial national ownership and effective control of an airline designated as national. For an airline to be a national Canadian air carrier, substantial ownership and effective control must be held by Canadians — citizens, permanent residents, a government or government agent, and entities in which Canadians own and control at least 75 percent of the voting interests or "such lesser percentage as the Governor in Council may by regulation specify."[12]

If a Canadian air carrier that flies international routes were, by virtue of foreign investment, no longer owned and under effective control by Canadians, its designation as a national airline under the relevant bilateral agreements could be challenged. This challenge could come from the remaining Canadian air carriers, the other country party to the bilateral agreement, or from carriers in competition with the newly controlled airline. Under the existing international rules, this challenge would probably succeed.

Foreign control may also affect the ability of the government to ensure the availability of domestic service in emergency situations. The *Emergencies Act* provides the Canadian government with the power to requisition the use of any equipment, which includes aircraft on Canadian territory, in times of a declared emergency. Other governments have similar laws. A foreign government might act on prior knowledge, however, and order aircraft owned, or even operated, by its nationals, to be returned to its territory (in a manner similar to the control over shipping demonstrated in the days preceding World War II).

Restricting foreign ownership and control may reduce choices to the consumer. This would be of particular concern if a situation arises where only one domestic carrier remains viable. We recognize that there are instances when a relaxation in foreign ownership controls may be necessary to preserve domestic competition (we return to this later). For the most part, though, we believe existing restrictions on foreign ownership and control of Canadian air carriers are appropriate, given the current bilateral air agreement regime.

Therefore, we **recommend** that:

**11.1 The federal government retain the existing limits on foreign ownership and control of air carriers.**

Canada also restricts individual ownership of air carriers. These restrictions ensure that shares in the air carriers remain widely held and that control by current management is preserved. We believe that such restrictions are undesirable. The unrestricted trading of shares exerts an important check on corporate management. In equity markets that function well, excellent management is more likely because badly managed companies are more easily taken over.

Therefore, we **recommend** that:

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**11.2 The 10 percent ceiling on individual holdings, which currently applies to Air Canada and Pacific Western Airlines (the parent of Canadian Airlines International), be eliminated.**

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## CONSOLIDATION OF THE INDUSTRY

Since we commenced our studies, dramatic changes have occurred in the airline industry. As we move through this decade and into the 21st century, the number of international carriers may well shrink, and changes will continue. These changes will have a profound effect on Canada's carriers and domestic airline services. As well, Canadian air carriers will face more formidable competition in their international operations.

The world's airlines are undergoing major restructuring. In part, this restructuring has taken the form of a shift toward partial or full private ownership of several airlines that were previously government-owned. In addition, a severe recession in North America has hastened the collapse of several U.S. carriers, resulting in the emergence of three super-carriers in that country. Through inter-carrier equity investment and the sharing of resources, management, labour, equipment and bases, several more super-carriers will likely emerge worldwide.

It is well to remember, however, that there are over 200 member airlines in the International Air Transport Association (IATA), and that many of these companies will continue providing essential services throughout the world. Will Canada's national carriers be included in this group? We believe that they will as long as their vision takes into account new pressures, challenges and opportunities.

It is possible that Canadian carriers will be able to operate successfully as independent carriers in the new mega-carrier world. On the other hand, they could become pivotal partners of one of seven or eight world-scale airlines. The outcome for Canadian air carriers — between these two possibilities — will depend on the evolution of national, continental and world markets, as well as improvements in technology, but, above all else, on their ability to be competitive, to change, to improvise, to find a special role, and to provide superior service.

We are optimistic that Canadian air carriers will have the realistic and creative energies to meet this challenge as Canada enters the 21st century.

We have considered the arguments of those who believe that the Canadian market can sustain only one major carrier, and that a merger of Air Canada and Canadian Airlines International is desirable. In 1989, the airline resulting from such a merger would have ranked 11th out of the top 50 airlines in the world in both passengers and passenger-kilometres. The advantage of such a merger is that the resulting carrier would carry more passengers and could thereby incur lower operating costs per passenger. The disadvantage of a merger is that, despite the freedom of other carriers to enter the market, domestic air transportation could become dominated, once again, by a single carrier monopoly.

We believe that the federal government should not attempt to restructure the airline industry. Rather, government policy should permit Canadian air carriers to increase their efficiency and to develop whatever market niche they can most effectively fill in the evolving airline industry.

To this effect, we **recommend** that:

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**11.3 The federal government invite Canadian air carriers to make public proposals for future international air route designations, with the airline offering the best package to be granted the route and the reasons to be made public.**

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Further, we **recommend** that:

**11.4 Canadian air carriers be allowed to sell designated international air routes to one another.**

Given our view that carriers will make the required adjustments toward efficiency and market niches without interference or assistance, we **recommend** that:

**11.5 Governments abstain from making any financial contribution that is intended to ensure the survival of air carriers.**

This recommendation, of course, does not preclude purchase by governments of designated services on market terms. The federal government should be prepared, however, to prevent a situation that would require a return to economic regulation, which would be the likely outcome if only one major Canadian air carrier emerges. At the time of writing, discussions were under way regarding a potential merger between Air Canada and Canadian Airlines International. The presence of only one major airline in the domestic market is inadvisable. While we are concerned with the survival of the airline companies, our overriding policy consideration is to maintain competition between at least two air carriers. We believe that Canadian travellers will be best served if there are two or more major competing carriers in Canadian skies. Maintaining competition should be the overriding policy consideration.

Therefore, we **recommend** that:

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**11.6 If faced with a potential reduction to only one major Canadian air carrier, the federal government exercise its authority under sections 67, 72 and 73 of the *National Transportation Act, 1987* to override limitations on foreign ownership and control for the explicit purpose of, and to the extent required for, ensuring competition in the domestic market.**

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## OPEN SKIES

The term "open skies" has been used to indicate a considerable opening of the United States–Canada border to flights to and from both countries. Increasing trade and visitor traffic have put pressure on both countries to renegotiate the United States–Canada bilateral air treaty.

There has been much discussion in the media over the past few years about the concept of open skies, in particular with the United States. One version of open skies would mean a continental free market for airlines. Carriers from each country would be allowed to fly any routes in either country. This would specifically include cabotage rights where airlines of both countries are permitted to transport travellers from one destination in the other country to another destination in that same country.

At our hearings, it was apparent that, other than representatives of airlines and a few others with closely related interests, members of the public generally were not talking about this version of open skies. What they did want, and strongly argued for, was direct service from their communities to additional destinations in the United States.

Canadians are interested in better access to foreign airline networks. They want more and better air service. This presents a real problem in negotiating a sound bilateral agreement with the United States that will meet the wishes of Canadian consumers and at the same time preserve the viability of Canada's two major carriers.

Equality of opportunity and equality of benefits for Canada's airlines are almost impossible to attain. To counteract the current dominance of U.S. carriers flying into major Canadian cities, Canadian carriers must be given the same access to all major U.S. cities, with guarantees of slots and gates. This might more accurately be termed an "open borders" policy, or "point-to-point" open skies. Under this arrangement, cross-border access would be eased considerably and Canadian consumers would get the additional service they have been demanding. U.S. airlines would benefit by adding new Canadian spokes to their hubs in the northern United States. Canadian air carriers could create Canadian hubs that would add spokes to the United States. Canadian firms would still retain all domestic flights and their international connections.

While we are in favour of open borders, we believe that Canadian carriers will require some time to prepare to meet the expected U.S. competition, which will likely concentrate on one or more of the three major centres, Vancouver, Toronto and Montreal. This period need not be prolonged. Canadian carriers must be prepared, as soon as possible, to meet this and other challenges developing worldwide. It is also well to remember that the Canada–United States Free Trade Agreement is being phased in over 10 years.

Canadians also want one or more Canadian airlines. We believe that the interests of the nation and of Canadian travellers will be best served if there are two or more major competing Canadian carriers. This should be a primary policy consideration in the renegotiation of the United States–Canada Bilateral Air Treaty.

If easing the restrictions on access to the Canadian air market and relaxing foreign ownership limits are not sufficient to maintain two major Canadian carriers, then the availability of competing services should continue to be the overriding consideration. In this event, Canada should seriously consider ways and means to ensure competition on domestic routes. This would entail one or more of the following:

- favouring alliances between Canadian and foreign carriers;
- favouring easier access for new entrants to terminals and landing slots; or
- relying on the Bureau of Competition Policy if there is abuse of monopoly power.

If all efforts to create domestic competition fail, we would recommend that the federal government consider opening up certain domestic routes to foreign airlines.

# ENDNOTES

1. Both Air Canada and Pacific Western Airlines (PWA) are subject to restrictions — including ownership restrictions and head office location — under their respective Acts.

2. Air Canada was created in 1937 but was called Trans-Canada Airlines until 1965.

3. By contrast, regulations administered in the United States by the Civil Aeronautics Board (CAB) did not afford the trunk carriers the protection they required to carry out an effective program of internal subsidization. (Many of the major routes were served by more than one trunk carrier.) U.S. carriers could not engage in price competition since the CAB regulated the level and structure of fares. But they could compete by increasing flight frequency, improving the comfort of aircraft and offering in-flight amenities. This non-price competition, which occurred in long-haul markets, ultimately eliminated the surplus that was necessary to sustain service on unprofitable routes.

4. For example, a recent review of available research on U.S. deregulation concludes:

   "At the outset of deregulation only about 20 percent of city-pair markets had three or more competitors; this share has grown to 40 percent. City-pair markets with three or more competitors serve about two-thirds of passenger trips. To date, this competition has generated many benefits for consumers. The freedom given to managers by deregulation to realign their routes and costs has resulted in a more efficient industry. Average fares have increased more slowly than costs, although most bargains occur in markets in which three or more carriers compete for service, especially when one of those competitors is a low-cost, new-entrant airline. The development of hub-and-spoke networks, spurred by deregulation, has expanded the frequency and availability of service in most parts of the country. In addition, rural areas, which used to receive subsidized jet-carrier service, continue to receive air service, though now via smaller turboprop aircraft. Substantial improvements in the frequency and timeliness of service have occurred in most rural areas. Even while the industry has evolved and service has expanded, accident and fatal accident rates have been lower than during the period before deregulation."

   Transportation Research Board, National Research Council, *Winds of Change: Domestic Air Transport Since Deregulation* (Washington, D.C., 1991), Special Report 230, p. 2.

5. There is anecdotal evidence of Canadians driving several hours to take advantage of substantially lower U.S. airfares on international and transcontinental flights and other flights to U.S. destinations.

6. "Canadian" includes Canadian citizens, permanent residents within the meaning of the *Immigration Act*, a government or government agent, and entities that are 75 percent controlled by Canadians.

7. The *Pacific Western Airlines Act* was recently amended. The previous provision regarding holdings restricted the holdings of any one person or group to 4 percent of the voting shares.

8. The objective of yield-management systems is to maximize revenues by, in part, minimizing the number of empty seats on flights. Computer programs allow the airlines to predict the number of empty seats on each flight and to determine the nature of the discounts that are required to attract sufficient new passengers to achieve full capacity. The yield-management system will also help airlines determine the nature of the restrictions or discount fares (such as advanced booking, advanced purchase, minimum and maximum stay, no cancellation) required to reduce the diversion of potential full-fare passengers to

discount fares. The computer keeps a running check on actual bookings compared with expected bookings on each flight and flags those flights for which there is a need to attract additional passengers or make other adjustments.

9. Changes in revenue tonne-kilometres per employee reflect changes in load factor, and hence capture the results of the innovations in load management discussed above. They also incorporate the effect of efforts to increase seat-km per employee; using this latter measure, labour productivity increased by 3.4 percent annually between 1984 and 1990, compared with only 0.4 percent annually between 1975 and 1983.

10. The *Competition Act* provides for a remedial solution when competition is precluded because someone is withholding an essential input. In these circumstances, the Competition Tribunal can order that the required input be made available to the aspiring competitor on the usual trade terms.

11. Air transportation to, from and within Canada accounts for slightly more than 2 percent of all global air markets. The mix of domestic and international passenger traffic varies considerably from one country to another. The United States has a low proportion of international service, about 24 percent, while the United Kingdom's carriers depend on international traffic for 97 percent of their revenue.

    For Canada, the mix is more balanced. In 1990, Canadian carriers, scheduled and charter together, carried some 37 million passengers, of which approximately 65 percent travelled between domestic and international destinations. Travel to and from the United States (measured by number of one-way trips) was 50 percent of Canada's total international market.

    The report of a task force established by the Minister of Transport to review Canada's international aviation policy to prepare for emerging global trade and travel patterns, published in January 1992, provides more detailed information on the importance of the Canada–United States trans-border air market and overseas markets.

12. This is the definition of "Canadian" under section 67(1) of the *National Transportation Act, 1987*.

# CHAPTER 12

# APPLYING THE PRINCIPLES TO RAIL CARRIERS

## INTRODUCTION

In this chapter we review the rail industry in Canada, the railway companies that provide intercity, remote access, tourist and extended commuter services and the views Canadians expressed to us on passenger rail issues.

We then undertake a more detailed examination of the operations, financial performance and future prospects of VIA Rail, including a comparison of VIA Rail with Amtrak, the United States' national passenger rail service. We conclude this section with our recommendations for the main passenger rail operations and for remote rail services.

We then consider the issues raised by proposals for new high-speed rail services, and make recommendations about how to approach high-speed rail decisions.

## THE PASSENGER RAIL INDUSTRY IN CANADA

In Canada, passenger rail's share of the intercity travel market has declined. As in Europe and the United States, where car travel predominates and air travel has increased substantially for longer trips, the share of rail travel has declined and rail is now used primarily for shorter trips.

VIA Rail accounts for more than 90 percent of intercity passenger rail travel in Canada. VIA Rail inherited most of the nation's passenger rail operations by the late 1970s, when the federal government relieved Canadian National Railways (CN) and Canadian Pacific Ltd. (CP) of the responsibility for these services. Unlike the passenger railways of other countries, including Amtrak in the United States, VIA Rail does not own large quantities of track, but rents track from the freight railways.

Other railways also provide intercity passenger services in Canada. The Ontario Northland Railway (ONR) is provincially owned. It provides service six days a week between Toronto and Cochrane (776 kilometres), and, three days a week, a mixed freight and passenger train service in the remote area between Cochrane and Moosonee (300 kilometres). The ONR also provides daily tour service between Cochrane and Moosonee during the summer.

The Ontario government's subsidy for ONR includes capital financing and approximately $15 million annually for operating expenses. The $15 million includes a federal subsidy ($2 million in 1989) paid through CN and the ONR to the government of Ontario for the Toronto to North Bay part of the Cochrane service.

The Algoma Central Railway (ACR) provides service between Sault Ste. Marie and Hearst (476 kilometres) six days per week during summer and three days per week during winter. Most of this route is without road access. Algoma Central Railway also operates tours on this route that account for the majority of its passenger revenues. During the 1980s, ACR received $15 million under the terms of a joint federal-provincial agreement. In addition, federal taxpayers pay approximately $2.5 million per year for this service.

The provincially owned British Columbia Railway (BCR) offers daily service between North Vancouver and Lillooet (254 kilometres). Trains continue through to Prince George (490 kilometres) three days per week and daily during the peak season. Over half of the ridership consists of tour groups. British Columbia taxpayers provide approximately $3 million a year for operations, with separate funding for the purchase and upgrading of passenger equipment as required.

The Quebec North Shore and Labrador Railway (QNS&L) provides twice-weekly mixed train service from Sept-Iles to the Schefferville–Labrador City area (about 600 kilometres through an area without road access). The federal government pays approximately $1 million in annual subsidies for this service.

Ontario's GO Transit and the Montreal commuter services provide shorter distance intercity services, and there are small tourist services in the Yukon Territory, Alberta, Ontario, Quebec and New Brunswick. Also, Rocky Mountaineer Rail Tours, a private-sector company, operates two routes: one between Vancouver and Calgary, through Banff, and the other between Vancouver and Jasper. Rocky Mountaineer Rail Tours receives no subsidy.

Amtrak offers daily trains between Toronto and Chicago, via Sarnia, and between Toronto and New York, via Niagara Falls. Amtrak's Toronto trains, which carry passengers between cities within Canada, are operated by VIA Rail and subsidized as part of the VIA Rail network. There are no Canadian subsidies for Amtrak's two services between Montreal and New York or Washington, D.C., since they do not carry passengers from point to point within Canada.

Most passenger rail services in Canada are subsidized (Table 12-1). Federal taxpayers cover 100 percent of VIA Rail's losses and 80 percent of the losses for federally chartered carriers required to provide passenger rail services. Provincial taxpayers pay for losses incurred by provincially owned railways. Although passenger rail systems in most other countries recover a somewhat greater percentage of their costs than does VIA Rail, they are government-owned and operated and require substantial taxpayer support in terms of funding.

*Table 12-1*

*DIRECT GOVERNMENT SUBSIDIES PAID FOR PASSENGER SERVICES IN CANADA, 1987*[a]

| Company | Operating subsidy ($ millions) | Passengers ($ thousands) | Passenger-km ($ millions) | Revenue per passenger-km (¢) | Subsidy per passenger-km (¢) |
|---|---|---|---|---|---|
| VIA Rail | 499.0 | 5,865.0 | 2,092.6 | 9 | 24 |
| BCR | 2.5 | 78.9 | 18.2 | 9 | 14 |
| ONR | 16.1 | 132.4 | 53.6 | 8 | 30 |
| ACR | 2.3 | 39.8 | 9.0 | 10 | 26 |
| QNS&L | 1.0 | 18.7 | 5.4 | n/a | 18 |

**Source: Information from carriers.**

**a. Amounts are approximate. In addition, there were losses and capital contributions borne by shareholders (including governments) or cross-subsidized by the freight traffic.**

## WHAT CANADIANS TOLD US

By far, the majority of people who appeared at our public hearings spoke about passenger rail service. The views on passenger rail were the most strongly held views that we heard. There was a belief among most interveners that passenger rail had served Canadians well in the past, that it was necessary for the future, and that it was faltering today because it had not been given a fair chance by the federal government.

Canadians' reasons for supporting passenger rail vary. Rail support groups and environmental groups argued that rail is the most environmentally friendly mode of travel, and is also the safest and most accessible mode of travel. Some local governments, especially in regions whose services were cut in 1990, saw passenger rail service as vital to their local economies. The tourism industry noted passenger rail's value in attracting foreign visitors. Unions argued for the necessity of preserving existing rail jobs. Still others argued, especially in the case of new high-speed train technology, that greater investment in passenger rail service will provide a general boost to the economy.

Many Canadians see rail service as a right. They made the point that rail had played a key role in building Canada, and continues to play a role in holding the country together. Those who had been directly affected by the VIA Rail cuts often expressed outrage at what they saw as the loss of an important transportation option. Even communities that had not been served by passenger rail for many years called on the federal government to reinstate VIA Rail services.

Many interveners felt that passenger rail had been set up to fail and that the solution lies in fixing VIA Rail. Many supporters of rail, and VIA Rail itself, argued that rail service cannot succeed until VIA Rail is given the freedom to manage without federal government interference. Rail unions stated that VIA Rail had been mismanaged from the beginning. Some groups, such as the Western Rail Passenger Restoration Committee, suggested that VIA Rail would be much better off if it were modelled after Amtrak. One widely expressed view was that an infusion of capital would allow VIA Rail to succeed, and that this expenditure would be justified because governments in Canada now subsidize the other modes of passenger travel. Few interveners suggested how Canadians could pay for passenger rail service if its potential ridership would not support it.

Other interveners pointed to high-speed rail service in Europe as an example of how passenger rail can be successful. It was suggested that, in addition to passenger transportation benefits, a high-speed rail project in the Toronto to Montreal corridor would boost the economies of both Ontario and Quebec. Few interveners felt that high-speed rail could succeed without taxpayer help — at least in providing the necessary infrastructure.

## VIA RAIL

### FINANCIAL PICTURE

During the 1980s, VIA Rail's passenger volume and average trip length declined. Table 12-2 shows VIA Rail's financial and operational performance from 1980 through 1991. Annual passenger volume dropped from 7.6 million in 1980 to 6.5 million by 1989, and passenger-kilometres dropped from 3,104 million to 2,442 million in the same period, reflecting shorter average trip lengths. The 1990 and 1991 figures reflect the cuts to service in January 1990, and those for 1990 include some costs associated with the transition to less service.

*Table 12-2*
*VIA Rail: Financial and Operational Results, 1980–1991*

| **Results** | **Year** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1980** | **1983** | **1986** | **1988** | **1989** | **1990** | **1991** |
| Passengers (thousands) | 7,586 | 6,541 | 6,286 | 6,415 | 6,457 | 3,536 | 3,633 |
| Passenger-km (millions) | 3,104 | 2,411 | 2,261 | 2,299 | 2,442 | 1,263 | 1,320 |
| Operating deficit per passenger-km (¢) | 10 | 19 | 21 | 25 | 22 | 31 | 28 |
| Total subsidy ($ millions) | 408 | 598 | 506 | 637 | 532 | 382[b] | 368[c] |
| Subsidy (percent)[a] | 74 | 75 | 71 | 74 | 68 | 73 | 71 |

**Source: VIA Rail annual reports and corporate plan summaries.**

**a. Government funding, including capital funding, as a percent of total expenditures.**
**b. Does not include $60 million for network restructuring.**
**c. Does not include $25 million for network restructuring.**

VIA Rail's subsidy grew from $408 million in 1980 to $637 million in 1988. After the federal government cut routes in 1990, the subsidy fell to $382 million. Adjusted for inflation, the increase prior to the VIA Rail cuts was small — only 5 percent in 10 years. Despite an increase in revenues, the operating deficit per passenger-kilometre (adjusted for inflation) increased by 27 percent.

From its inception through 1991, VIA Rail cost Canadian taxpayers $5.6 billion in operating losses and $1.2 billion in capital expenditures — for a total of $6.8 billion in subsidies.

## SERVICES AND COSTS

In 1989, before the cutbacks, VIA Rail offered more than 35 different passenger rail services. We have grouped the non-remote services as follows:[1]

- Toronto–Ottawa–Montreal (Tor–Ott–Mtl);
- Southwestern Ontario (SO);
- Western Transcontinental (WT), Vancouver to Toronto;
- Eastern Interprovincial (EI), between Montreal and the Maritimes; and
- Regional, Maritime and others.

Could VIA Rail's services recover more of their costs in the future and become self-sufficient? To answer this question, we examined non-remote service groupings, including services terminated in January 1990. We considered a scenario (Table 12-3) in which VIA Rail increased ridership, raised fares and brought in greater revenues. We adjusted VIA Rail's recent actual service costs to reflect anticipated improvements that could result from better labour practices, modern equipment and reduced overhead costs. For example, we assumed engine and train crew reductions for certain services. In addition, we reduced equipment maintenance costs to reflect anticipated economies from recent and planned equipment investment and renovation.

As far as was feasible, we used the same financial parameters in our calculations for passenger rail as were used for the other modes. We included depreciation and interest on the investment in passenger locomotives and cars, and the costs of using the track are included as these are direct payments by VIA Rail to the track owners. We did not include full capital charges for the investment in stations, maintenance shops and other publicly provided infrastructure; therefore, VIA's costs are slightly underestimated.

Even with the assumed improvements shown in Table 12-3, no VIA Rail service could recover its costs without steep price increases. Modernized, efficient equipment, improvements in crewing practices, and other economies would reduce the cost of passenger rail operations. The result, shown in Table 12-3, would be a major improvement in VIA Rail's cost recovery and, consequently, a significant reduction in subsidies from Canadian taxpayers. Such economies, however, would not result in any of the services approaching self-sufficiency.

*Table 12-3*
*VIA Rail Services — Adjusted for Anticipated Improvements, $1990*[a]

| | Tor-Ott-Mtl | SO | WT | EI | Maritime Regional |
|---|---|---|---|---|---|
| Annual passengers (thousands) | 2,004 | 1,326 | 202 | 297 | 275 |
| Average trip length (km) | 351 | 183 | 1,430 | 716 | 229 |
| Load factor (percent) | 70 | 47 | 79 | 64 | 36 |
| Passenger-km/train-km | 191 | 122 | 158 | 183 | 43 |
| Revenue ($ millions) | 76 | 31 | 31 | 19 | 5 |
| Revenue per passenger-km (¢) | 11 | 13 | 11 | 9 | 8 |
| Costs of operations ($ millions) | 83 | 44 | 63 | 45 | 14 |
| Customer service ($ millions) | 31 | 18 | 12 | 10 | 4 |
| Administration ($ millions) | 13 | 7 | 8 | 6 | 2 |
| Capital charges ($ millions) | 20 | 15 | 20 | 20 | 5 |
| **Total costs ($ millions)** | **146** | **84** | **103** | **81** | **25** |
| Deficit ($ millions) | 70 | 54 | 72 | 62 | 20 |
| Cost recovery (percent) | 52 | 36 | 30 | 24 | 20 |
| Subsidy (percent) | 48 | 64 | 70 | 76 | 80 |
| Deficit per passenger ($) | 35 | 40 | 356 | 209 | 73 |
| Deficit per passenger-km (¢) | 10 | 22 | 25 | 29 | 32 |

**Source: Royal Commission staff estimates from data provided by VIA Rail.**

[a] **Where available, 1990 data were adjusted for assumed improvements in costs, ridership and revenues (see text). The "Maritime Regional" column is based on data for VIA Rail's (pre-cuts) 1989 Maritime regional services with similar adjustments. Totals do not always add up due to rounding.**

Most VIA Rail services discontinued in 1990 had particularly low cost recovery. The routes included in the Maritime Regional services column of Table 12-3 were discontinued. Even allowing for reasonable improvement in both costs and revenues, these services would remain far from recovering operating costs.

VIA Rail's remote services have declining ridership and high costs. The federal government contracts with VIA Rail to operate eight mandatory services that include remote locations without access to all-weather roads. A ninth is serviced by the Vancouver to Toronto train. Ridership on remote services is shown in Table 12-4. Demand for these services has been declining, while costs have been increasing. The estimates of the costs to taxpayers of VIA Rail's mandatory services are shown in Table 12-5.

*Table 12-4*

*MANDATORY SERVICES ANNUAL RIDERSHIP, 1985–1990*[a]

| Route | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
| Prince Rupert–Jasper | 23,334 | 29,712 | 26,817 | 26,665 | 27,171 | 16,766 |
| Winnipeg–Churchill | 57,493 | 50,334 | 52,009 | 48,847 | 44,298 | 30,446 |
| The Pas–Lynn Lake | 11,616 | 9,156 | 8,660 | 8,871 | 7,679 | 8,603 |
| Wabowden–Churchill | 1,631 | 1,041 | 962 | 797 | 399 | 210 |
| Winnipeg–Capreol | 71,643 | 65,057 | 54,616 | 54,101 | 48,479 | b |
| White River–Sudbury | 8,598 | 10,423 | 9,590 | 10,195 | 9,805 | 4,715 |
| Cochrane–Senneterre | 6,815 | 5,997 | 5,329 | 5,043 | 4,293 | 1,591 |
| Senneterre–Montreal | 54,615 | 50,798 | 42,979 | 43,197 | 38,131 | 21,759 |
| Jonquiere–Montreal | 37,295 | 34,416 | 31,350 | 31,400 | 27,248 | 11,937 |

Source: Data provided by Transport Canada.

a. Includes traffic handlings to non-remote segments of routes.

b. Service to remote area provided by Vancouver–Toronto train since 1990.

There is little potential to improve cost recovery for the mandatory services by increasing revenues. Even a doubling or tripling of fares would have only a minor effect on losses. To reduce subsidies, the costs of providing mandatory services would have to be considerably reduced. VIA Rail could achieve this cost reduction if it limited services to truly remote areas. We do not believe that it is sensible to massively subsidize hundreds of kilometres of passenger railway service in areas where there are parallel road and bus services, and, in some cases, air services.

*Table 12-5*
*MANDATORY SERVICES COST RECOVERY, 1990*

| **Route** | **Total subsidy ($000)** | **Recovery ratio (%)** | **Subsidy per passenger-kilometre ($)** |
|---|---|---|---|
| Prince Rupert–Jasper | 12,688 | 7 | 1.24 |
| Winnipeg–Churchill | 19,409 | 8 | 1.24 |
| The Pas–Lynn Lake | 1,267 | 10 | 0.78 |
| Wabowden–Churchill | 59 | 8 | 1.26 |
| Winnipeg–Capreol | Served by the Western Transcontinental | | |
| White River–Sudbury | 3,082 | 3 | 3.45 |
| Cochrane–Senneterre | 1,927 | 2 | 11.00 |
| Senneterre–Montreal | 9,799 | 6 | 1.70 |
| Jonquiere–Montreal | 5,587 | 5 | 1.92 |
| **Total excluding Winnipeg–Capreol** | **53,818** | **7** | **1.44** |

**Source: Royal Commission staff estimate based on data provided by Transport Canada.**

## COMPARING VIA RAIL WITH AMTRAK

The passenger rail systems of most other countries would not, generally, serve as useful comparisons with Canada's passenger rail services. In Western Europe, rail is used primarily for passengers, with freight being a secondary activity. The opposite is true for Canada. The geography of Europe, with large, densely populated cities in close proximity to each other helps to make train travel preferable to air travel between population centres.

Amtrak operates in a geographic and cultural environment somewhat like that of Canada. Distances between cities in the United States are large, and most Americans prefer car and air travel to passenger rail.

Amtrak's percentage of cost recovery has improved steadily. Table 12-6 shows that Amtrak has had decreasing deficits and subsidies since 1983. Officials from Amtrak state that operating deficits will disappear by the end of the century, but that the government must continue to provide a capital subsidy.

*Table 12-6*

*AMTRAK: FINANCIAL AND OPERATIONAL RESULTS, 1983–1989*

| Results | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
| Passengers (millions) | 18.9 | 19.5 | 20.8 | 20.3 | 20.4 | 21.5 | 21.4 |
| Passenger-km (millions) | 6,807 | 7,127 | 7,768 | 8,071 | 8,406 | 9,142 | 9,433 |
| Operating deficit per passenger-km (¢) | 12 | 13 | 10 | 08 | 08 | 07 | 07 |
| Total subsidy ($ millions) | 977 | 980 | 935 | 776 | 774 | 644 | 619 |
| Subsidy (percent)[a] | 60 | 57 | 54 | 48 | 45 | 37 | 33 |

**Source: Royal Commission staff calculations based on data from Amtrak annual reports.**

**a. Government funding as a percentage of total expenditures.**

Why is Amtrak's performance better than that of VIA Rail? We identified a number of reasons why Amtrak is enjoying lower deficits and better cost recovery. To start with:

- Amtrak uses up-to-date, efficient rail equipment.
- Amtrak's labour practices permit higher productivity than VIA Rail's.
- Amtrak has a more favourable formula than VIA Rail for paying the freight railways for use of their track, although the difference only accounts for a 1 to 2 percent difference in total costs.
- From the beginning, VIA Rail had less freedom to make decisions due to the lack of a legislated mandate. Unlike Amtrak, VIA Rail was forced to take over all routes previously served, whereas the least viable U.S. routes were discontinued before Amtrak took over.
- In 1989, Amtrak had $400 million in general revenue from non-intercity passenger rail business such as commuter services, from equipment maintenance services, from charges to freight railways for use of its track in the northeast corridor of the United States and from carrying mail.

But these reasons do not explain all the differences between VIA Rail's and Amtrak's performance. Some of the remaining difference lies in the nature of the services offered by each company.

VIA Rail offers more services relative to population size. Before comparing individual services, we note that, even after the 1990 service cuts, VIA Rail still provides about 30 percent more passenger-kilometres of service per Canadian than Amtrak does per American. VIA Rail also has about three times the length of route network per capita. Thus, the average number of riders on VIA Rail per kilometre is lower than that of Amtrak, and VIA Rail has many more routes with very low ridership. Amtrak has no services with fewer than 40,000 passengers per route-kilometre, whereas VIA Rail, even after the 1990 cuts, has several such services (Chart 12-1).

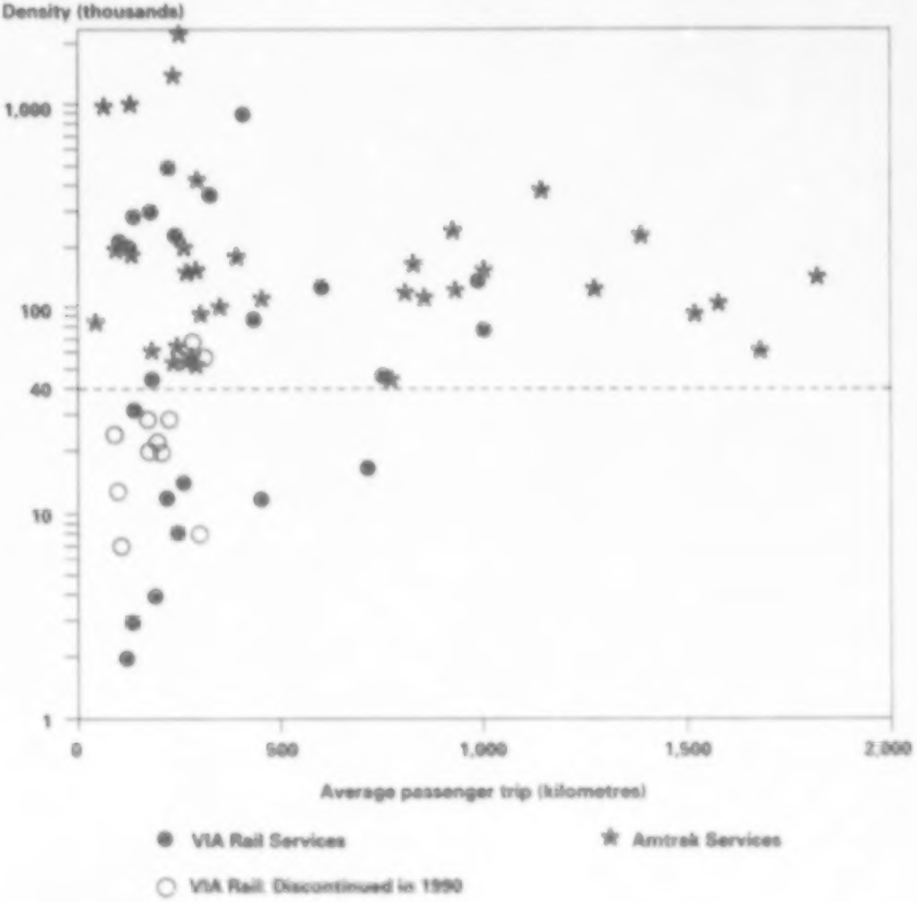
Chart 12-2 shows the operating cost-recovery ratio for selected Amtrak and VIA Rail services. To improve comparability we have excluded Amtrak's Metroliner service between New York and Washington, D.C., services where the average passenger travels less than 100 kilometres, and services where sleeping accommodation is provided. As Chart 12-2 demonstrates, VIA Rail's lowest density services, some of which were eliminated in 1990, have very poor cost recovery and few services recover their operating costs.

Cost recovery for VIA Rail would be improved by eliminating more of the less-used services, and improving service and increasing fares on the high-use routes. This strategy was adopted for Amtrak at its outset.

Some Amtrak services are similar in density and length to some VIA Rail services in the Windsor to Quebec City corridor. In some cases, their cost-recovery rates are also similar; in others, Amtrak's cost recovery is better for various reasons.

Chart 12-1

AMTRAK AND VIA RAIL SERVICES: DENSITY VERSUS AVERAGE TRIP LENGTH, 1989

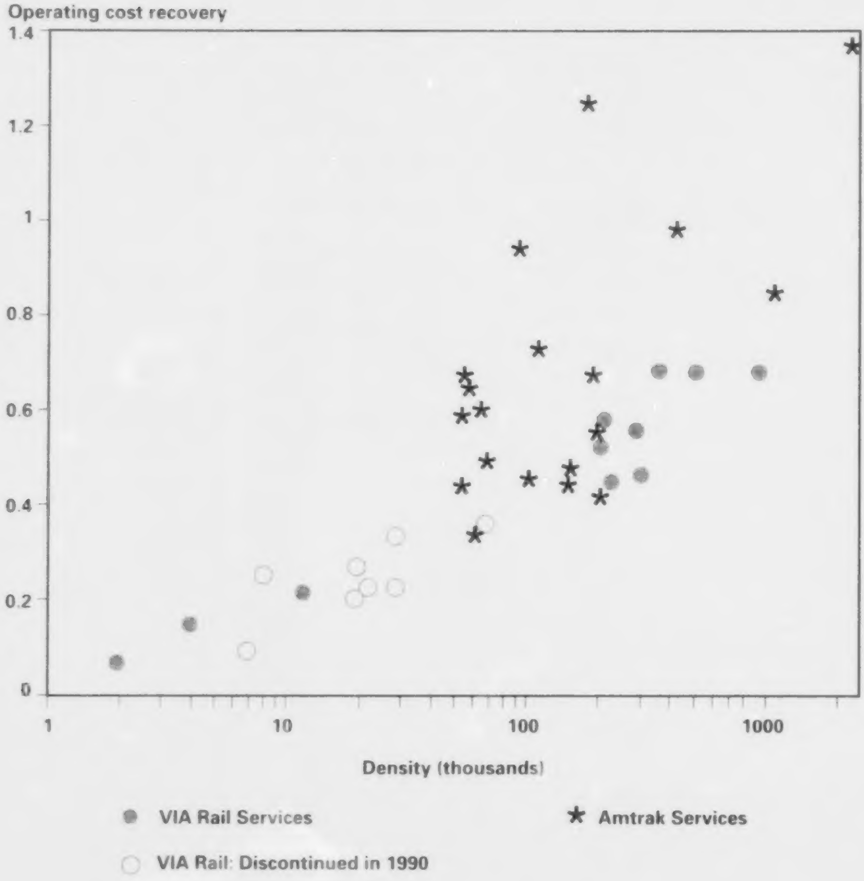


Sources: Data provided by carriers and Royal Commission staff calculations.

Note: Density = pass-km per route-km.

Chart 12-2

AMTRAK AND VIA RAIL: 1989 OPERATING COST RECOVERY FOR INTERMEDIATE DISTANCE NON-SLEEPER SERVICE



Sources: Data provided by carriers and Royal Commission staff calculations.

Note: Density = pass-km per route-km.

### EXAMPLES OF COMPARABLE VIA RAIL AND AMTRAK ROUTES AND THEIR RATES OF OPERATING-COST RECOVERY

| | | | |
|---|---|---|---|
| **1)** | **VIA Rail:** | **London–Toronto** | **53%** |
| | **Amtrak:** | **Milwaukee–Chicago** | **55%** |
| | | **Harrisburg–Philadelphia** | **41%** |

**This similarity in cost recovery indicates that, for certain kinds of routes, VIA Rail can equal Amtrak's financial performance.**

| | | | |
|---|---|---|---|
| **2)** | **VIA Rail:** | **Montreal–Quebec City** | **46%** |
| | **Amtrak:** | **Oakland–Bakersfield** | **67%** |

**In this case, the Oakland–Bakersfield route benefits from a substantial capital contribution from the state of California.**

| | | | |
|---|---|---|---|
| **3)** | **VIA Rail:** | **Toronto–Ottawa** | **69%** |
| | **Amtrak:** | **Niagara Falls–New York** | **98%** |

**Amtrak's high cost-recovery rate on the Niagara Falls–New York route can be attributed, in part, to high-performance turbo trains, whose capital costs are not reflected in Amtrak's figures.**

Unlike Amtrak, VIA Rail has no specific founding legislation. VIA Rail is accountable to the Minister of Transport for providing specified services in exchange for specified payments under the terms of an annual confidential contract. Transport Canada negotiates the terms of the contract and monitors performance. The Minister must approve any departure from the specifications in the contract. The National Transportation Agency has the power to regulate some aspects of VIA Rail's fares, and the federal government approves VIA Rail's operating and capital budgets.

Amtrak, on the other hand, was created by an Act of Congress, and is dependent for its operating deficit and capital funding on appropriation bills passed by Congress. Amtrak must answer to Congress regarding the financial performance of the corporation, and to individual members where its activities are of local interest. The corporation is accountable to the Federal Railroad Administration for safety matters only.

Amtrak's superior financial performance can be partially explained by differences between U.S. and Canadian markets, different accounting treatments and arrangements for payment for access to the track, greater renewal (at taxpayers' expense) of rolling stock, and assets that generate revenue from sources other than intercity railway passengers.

Representatives from VIA Rail, and others concerned about its future, told us that VIA Rail has been hindered by lack of a clear mandate and the authority to manage its own affairs. While we believe that the poor financial performance of Canada's passenger rail system is predominantly due to factors beyond any management's control, we agree that federal government involvement in investment and operations has worsened an already difficult financial situation.

## THE FUTURE OF VIA RAIL

Investing in new equipment would reduce VIA Rail's operating costs. The Minister of Transport's (1985) Task Force[2] stated that new equipment and modernization would be necessary if VIA Rail were to provide effective passenger rail service and to control its deficits. VIA Rail is currently rebuilding 1955-vintage cars at a cost in excess of $1 million per car, as well as completing a program of upgrading track, equipment, maintenance facilities and stations.

We recognize that VIA Rail's operating costs could be reduced and ridership improved by rebuilding or replacing equipment. Investment in new equipment, however, must be based on more than shifting deficits from the operating accounts to the capital account. Governments must decide whether VIA Rail should continue providing current services, or even continue as an entity, before undertaking any new long-term capital investments.

Heavily subsidized passenger rail is detrimental to competition with other modes. The principles of equal treatment and fair competition in our recommendations would be violated if a subsidized rail service continued to compete with non-subsidized modes that must face full market pressures. VIA Rail's presence with a subsidy in the market gives it an unfair advantage over both the air and the bus industries. Price competition is especially acute in the region between Windsor and Quebec City, where [illegible], air carriers and VIA Rail often operate parallel services.

We are also concerned that under-priced rail services might be overused relative to other goods and services in all sectors of the economy, including other modes of passenger transportation. Although the effect may not be substantial in the VIA Rail case, artificially underpriced transportation generally leads to inefficient decisions about travel and the way Canadians choose residential, business and recreational locations.

Fares based on full cost recovery would greatly increase the price of train travel. Full cost-recovery fares between Toronto and Montreal for one-way travel would average over $120, more than double the present average. For other VIA Rail routes and services, the required fare increases would be even higher. The average fare for an average (short) rail trip in southwestern Ontario would increase from $25 to $65. At such fares, the demand for rail travel would likely drop, requiring even higher fares to recover costs.

Pricing all transportation to include charges for environmental damage would, however, modestly improve rail's relative position on some routes. Some rail advocates suggested to us that if the pricing of all modes included charges for environmental damage, passenger rail might be attractive in terms of price. In terms of smog-creating pollution and carbon dioxide ($CO_2$) emissions, rail's performance compared with competing modes is mixed.[3] Transcontinental trains, with their sleeping and dining cars, consume more fuel per passenger-kilometre and create more $CO_2$ and other pollutants than airplanes or cars (Chapter 7).

Rail travel is generally less polluting than travel by air or car if enough trains with modern equipment operate at good occupancy rates over moderate distances — for example, the Toronto–Ottawa–Montreal service. Even with modern trains and good occupancy rates, rail is not less polluting than intercity bus. Compared with all the rail services we examined, and all classes of emissions, intercity bus provides service at a lower environmental cost per passenger-kilometre.

Although rail has not kept pace with the emissions reductions achieved by the car, bus or airplane, we recognize that changes in technology could reduce train emissions. Although the potential for emission reduction in conventional rail is limited in the short term, using improved diesel engines or electric trains could reduce emissions (depending on the source of the electrical power).

The expenditures required for the termination of VIA Rail would cost taxpayers approximately $300 million, or less than one year of subsidy. As a corporation, VIA Rail has obligations and long-term contracts, but also assets that could be sold. In particular, railway labour contracts negotiated during the late 1980s provide long-term guarantees of income to many employees. These contracts, which are similar to contracts with CN and CP, mean that, after eight years of work, many employees are guaranteed their salary until pension age, regardless of whether they work or not, provided they are available for work. Payments that might be required under these contracts are believed to have a present discounted value of $350 million.

Other costs for the orderly termination of VIA Rail would relate to lease- and supplier-contracts, unfunded pension liability, losses in revenue during the last months of train operations, payments for environmental damage and other costs of winding down a company. These costs would be offset by approximately $250 million from the net proceeds of the disposal of assets used in VIA Rail's operations — the sale of cars, locomotives, track, stations, maintenance shops and land.

## RECOMMENDATIONS FOR PASSENGER RAIL

The question of the future of passenger rail service and specifically VIA Rail was one of the most difficult — if not the most difficult — that we faced. Historically, Canada has had an enviable nation-wide passenger rail system that played a major role in the development of the country and was an essential service in times of emergency. And yet, changes in overall demand for passenger transportation during the last 40 years (Chart 2-5) have left passenger rail in a precarious position. Not one of VIA Rail's services, at present cost and revenue levels, approaches recovery of its operating costs, let alone capital costs. Nevertheless, significant numbers of Canadians from coast to coast expressed concern about the future of passenger rail and told us that they wanted the trains to continue running. Some interveners strongly supported both transcontinental and regional services. It is unlikely, however, that the VIA Rail operation, as currently structured, could become self-sufficient under our principles and objectives for future passenger transportation in Canada, even with full allowance for environmental charges.

We believe, however, that there may be a future for passenger rail in Canada, and that it should be given a chance under favourable conditions to prove itself in the same competitive market as all other modes.

We considered recommending a system whereby a number of service providers could bid for subsidies below the levels noted in Table 12-3. This would be in keeping with our "fit, willing and able" principle. There is, however, a risk that a permanent system of subsidies would emerge from this approach, or that VIA Rail would find itself dismantled and replaced in part by a number of even more fragile companies. For these reasons, we prefer a transition policy based on a continuation of VIA Rail as the primary provider of intercity passenger rail transportation.

Therefore, we **recommend** that:

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**12.1 The federal government pass legislation to give VIA Rail a corporate mandate that allows it to operate on a commercial basis, with such legislation to provide for:**

**(a) a "sunset" provision on the general subsidy that allows 10 years to achieve break-even, after which the subsidy would be withdrawn;**

**(b) a 10-year schedule of declining operating subsidies to VIA Rail so that such subsidies reach zero at the end of the 10-year period;**

**(c) a 10-year budget for VIA Rail for capital projects that have a reasonable chance of repaying the costs in future revenues;**

**(d) sufficient freedom to VIA Rail's management to ensure that it can exploit the advantages of the rail mode to the fullest, including investment, route selection, service levels and pricing, but having due regard for competition policies that prohibit predatory pricing;**

**(e) the ability for VIA Rail to borrow funds in the capital markets, but with no government guarantee, once the government is satisfied that VIA Rail will be viable; and**

**(f) any long-term commitment by VIA Rail, including wind-down costs, to be accounted for and provided for within the 10-year subsidy schedule.**

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Adherence to this mandate would be monitored by the National Transportation Agency. VIA Rail management would also, of course, be subject to general competition rules prohibiting anti-competitive behaviour. It would be important that competition policy prevent subsidized rail services from using predatory pricing to undercut bus and air services during the transition period.

VIA Rail can notify the federal government that it intends to abandon a route prior to the end of the transition period. In that event, the federal government should reduce the subsidy to reflect this. VIA Rail management should decide whether or not to have a transcontinental train, its frequency, and what route it should take. Other questions, such as the type of service (luxury, tourist, seasonal or year-round), would be handled the same way.

If a government believed that a different route should be served or that there should be greater service frequency, then that government would be required to say so publicly, to contract with VIA Rail for the service, and pay for the service out of their general tax revenues.

We expect that, on routes that it aimed to make viable, VIA Rail would make major efforts to improve service; these could include a reservation system with seat selection, terminals with better accessibility for travellers with disabilities and elderly travellers, and improved speed and in-train amenities to attract business travellers.

Provinces and regions might choose to operate regional or local passenger railways, or to contribute additional monies (through VIA Rail or another rail carrier) to achieve local objectives, such as reduced highway congestion, and improved urban development.

Therefore, we **recommend** that:

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**12.2 VIA Rail be free to compete for other services, including operating commuter services and transporting mail.**

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**12.3 VIA Rail be required to file with the federal government and to publish detailed annual operating plans and financial reports that include the costs and revenues related to individual routes.**

**12.4 At the end of 10 years, all routes be unsubsidized and open to any fit, willing and able new entrant.**

## REMOTE SERVICES

As we stated earlier, most of the 6,700 kilometres served by mandatory remote trains are not truly remote. Many of the routes are parallel to highways and are served by bus and air carriers, particularly between many of the larger centres. Since passengers have alternative modes of transportation available, rail ridership on these routes has been decreasing. These services have low cost-recovery rates, none recovering more than 10 percent of their costs (Table 12-5).

All remote services should be limited to bringing passengers to the closest convenient point of transfer to a commercial carrier. With few exceptions, a strictly remote route would not be physically connected to VIA Rail's network. These services would not require VIA Rail's marketing, reservations and customer services and might not need to be provided by VIA Rail. An example of such an alternative is provided for one such route in Chapter 18.

Mixed trains (freight trains with a passenger car, or even a combination passenger-local freight car) may be the cheapest way to provide rail passenger service in some remote areas. For example, mixed trains are used on the weekly Wabowden to Churchill service and on some runs from The Pas to Lynn Lake. Historically, the freight railways, which operate these trains, have not charged for crew, locomotives and track access when such passenger accommodations are added, but only for fuel and maintenance for the passenger cars.

Although mixed trains may provide an inexpensive alternative to passenger-only rail service, the combination of freight and passengers does have problems. While passenger service is usually on a fixed schedule, freight assignments often do not match the passenger schedules or routes. In addition, passenger service requires more stops than freight traffic, causing inefficiencies for shippers. Where mixed train service is appropriate, it may be simpler to have it provided by the freight carrier.

We therefore **recommend** that:

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**12.5 Where governments judge that a subsidy for passenger transportation to remote communities is justified:**

- **(a) the most efficient mode and carrier be used and, where feasible, a competitive bidding process be implemented;**
- **(b) any subsidized remote access service (regardless of mode) be designed to take passengers out to and bring them in from the closest convenient point where transfer can be made to a commercial unsubsidized carrier; and**
- **(c) subsidies and their purposes be open to public scrutiny.**

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## HIGH-SPEED RAIL

Governments and industry have been investigating high-speed rail for the Windsor to Quebec City corridor. The feasibility of high-speed rail in this corridor has been the subject of many studies by potential carriers, equipment manufacturers and governments. It has also had a great deal of promotion in the media. Early research on the viability of high-speed rail was inconclusive, prompting the provinces of Ontario and Quebec, in conjunction with the federal government, to initiate another series of studies. These studies are inquiring into the development, installation and operation of a high-speed rail system in the Windsor to Quebec City corridor. They include:

- assessing market feasibility;

- exploring specific technologies;
- identifying corridors, stops and interconnections with other transportation services;
- defining the roles of the private sector and governments in implementing high-speed rail; and
- assessing industrial benefits.

We have neither the expertise, the time, nor the budget to duplicate such studies and, therefore, cannot comment on the technologies available, the estimated costs, projected ridership or revenues of these systems. On the other hand, it is within our mandate and our resources to examine high-speed rail from the perspective of long-term transportation planning and policy.

There are many high-speed rail technologies on the market and more will become available in the future. In addition to the Swedish, Japanese, French and German high-speed, steel-wheel-on-rail technologies, both the Germans and the Japanese are developing magnetic levitation systems (maglev).

High-speed rail systems have high fixed costs and low variable costs. As a result, they need high ridership to be successful. Otherwise, they run large deficits. Successful high-speed rail operations in France and Japan have had ridership levels that have allowed them to charge moderate fares with a range of discounts. Modestly discounted fares create more demand for travel, which, in turn, leads to increased frequency and convenience in scheduling for travellers. This cycle has led to double-digit increases in ridership. The key issue is whether there would be enough riders in any Canadian corridor to pay the costs for a high-speed rail system.

There are already buses, airplanes and cars operating in these corridors, and a subsidized high-speed rail service would have unfair advantage over these private-sector services, and cause inefficiencies in the transportation system. In addition, with our recommendations concerning VIA Rail in place, some of VIA Rail's Windsor to Quebec City corridor services might become commercially viable. We believe that a high-speed rail system should be treated consistently with our principles. Any high-speed rail system, like any transportation system project, should be paid for by transportation system users who would benefit and not by the taxpayer. In particular, as we said in our Interim Report:

> From the point of view of an integrated transportation system, it is important that further studies give due account to spill-over benefits such as relief of congestion and reduction of accidents. Since there are joint costs and benefits in an integrated system, it is also important to assign each mode its correct costs. For example, some of the cost of building rail underpasses and overpasses should be assigned to highways, since highway users also benefit from the availability of this infrastructure, and since joint costs of intersections can be assigned to a single mode only if the other mode sharing the intersections has been given "right of way."

Therefore, we **recommend** that:

**12.6 Governments invest in high-speed rail infrastructure only when the expected transportation system benefits exceed the costs, and taxpayers do not have to pay any operating subsidy.**

**12.7 The benefits and costs of any high-speed rail project in which a government invests or subsidizes be made public and the public be consulted on the implications of the government's decision.**

**12.8 The federal government establish the regulations under which any high-speed rail system would operate, including safety and environmental regulations.**

In this chapter we have discussed how our principles can be applied to improve the passenger rail sector, a mode of transportation that is presently heavily subsidized.

# ENDNOTES

1. Some of VIA Rail's documents pool the results for all operations between Windsor and Quebec City.

2. A Rail Passenger Action Force (H.M. Horner, R. Fortin and N. Vincent) was appointed in November 1984 to report by May 1985. The Action Force's objective was a new national rail passenger plan.

3. This discussion is based on current VIA Rail technology. We discuss elsewhere the possible benefits from alternatives, such as high-speed electric railway technologies.

# CHAPTER 13

# APPLYING THE PRINCIPLES TO INTERCITY BUS CARRIERS

## INTRODUCTION

In examining the intercity bus carrier industry, we asked:

- What is the role of the bus in delivering economical transportation to Canadians?
- Would this role be more effectively performed if the industry were more open to new entrants?
- Would the intercity bus industry remain viable and competitive if economic regulation was substantially relaxed?
- Would a less-regulated bus industry still deliver transportation service to Canada's rural communities?

## THE BUS INDUSTRY IN CANADA

### MARKETS

Most bus travellers use this service because it is the cheapest form of intercity travel, particularly for those who do not have a car or who are unable to drive. Thus, those who use the bus most heavily are people of modest means, such as students and some older people. Most bus travel is for recreation or visits to family and friends, although there is some business travel on short-haul routes.

Some bus companies have had limited success in offering luxury services (with spacious seats, refreshments and other amenities) at higher fares than for conventional services. In general, however, premium bus services have failed to attract sufficient riders to render them viable.

Buses serve many Canadian communities. According to the *Official Canadian Bus Guide*, in 1991, the intercity bus industry provided scheduled service to approximately 3,000 points in all provinces and territories (down from 3,400 in 1978).[1] Most travellers use the bus for short trips. In 1991, bus passengers travelled an average distance of less than 200 kilometres.

Bus operations are diverse, from large operators with multiprovincial service to small carriers offering only local services. Greyhound Lines of Canada Ltd., the largest bus operator, has 400 buses serving an extensive route system stretching from Vancouver to southwestern Ontario, and north into the Yukon and Northwest Territories. Dewdney Trails operates a service three times a day each way between Castlegar and Trail, British Columbia, a 30-minute trip. An even smaller operation, Atlin Coach Lines, provides a combined freight and passenger service for six to eleven passengers daily from Whitehorse, Yukon Territory, to Atlin, British Columbia.

## REGULATORY ENVIRONMENT

Economic regulation of the scheduled intercity bus industry in Canada, in particular the restriction of entry by firms that would compete with existing services, continues today. This contrasts sharply with other countries that have opened the scheduled intercity bus industry to greater competition (notably the United Kingdom and the United States), and with the relaxed economic regulation of the air transportation and freight transportation industries in Canada. Bus regulation is enforced by provincial/territorial transport boards, which have authority over carriers whose operations are entirely within a single province or territory. In addition, the federal government has delegated its authority to the boards for carriers whose operations extend beyond the province or territory.

## COSTS AND REVENUES

Of all the types of passenger transportation, bus travel comes closest to paying its way. As we noted in Chapter 3, intercity buses pay fuel taxes that approximately cover the costs of their use of the roads, and would remain the most inexpensive type of public transportation if travellers paid the full costs of bus transportation, including charges for environmental damage and the costs of safety and accidents.

Many bus carriers also provide freight (parcel) services. In rural areas, the bus is often the only carrier of parcels that are over the Canada Post weight limit, and courier companies often use the bus service to deliver their packages. These freight services are an important source of revenue for bus carriers in remote and rural areas, but are much less significant to carriers in the more densely populated southern Ontario to western Quebec region, where a variety of courier, messenger and package delivery services compete for this business.

Charter services are also a source of revenue for the bus industry. In the more populous regions of Canada, most small, scheduled bus carriers and a significant number of the mid-size carriers earn most of their revenues from charter business, and to a lesser extent from school-bus contracts. For Greyhound, Voyageur Colonial and other large carriers, charter service is a profitable use of idle bus capacity.

## TRENDS

The bus industry is an important participant in intermodal passenger transportation. Buses provide a public link to and between other modes of transportation. For example, bus and van services connect communities, train stations and airport terminals.

The market share for intercity scheduled bus service has been declining steadily. Since the 1950s, bus ridership has been dropping while total intercity passenger travel has grown. The intercity bus has been steadily losing ground to the car for short-distance travel and to the airplane for long-distance trips. The bus must also compete with subsidized rail service, especially in the Toronto–Ottawa–

Montreal triangle and in southern Ontario. The bus industry has responded to declining ridership by cutting back service frequency and route-kilometres and by raising fares.

The bus industry is highly concentrated and regionalized. In 1987, the five largest carriers held nearly 90 percent of the value of the assets in the industry, earned 84 percent of the revenues, and carried 81 percent of the passengers — up from 66 percent in 1980.

In eastern Canada, most carriers exchange passengers at or near their provincial borders. To get from Hamilton to Halifax, a person must travel using five different carriers, changing buses each time. Only Greyhound provides significant multiprovincial service — from Vancouver to Toronto.

Buses do not pollute the environment as much as other types of passenger transportation do. Buses consume less fuel per passenger-kilometre, resulting in lower carbon dioxide emissions. Current diesel-engine buses do have significant smog-inducing emissions, but there is considerable potential for improvement.

## WHAT CANADIANS TOLD US

### THE PUBLIC

In our public hearings, Canadians had little to tell us about bus transportation. In our review of Canadians' travel preferences, we found that they view buses as uncomfortable, and particularly poor in seating space and ventilation. They also complain about the condition of some bus terminals.

### THE INDUSTRY

The strongest views on bus travel that we received came from the bus companies and their representatives, who made two major points:

The first point was that they suffer from unfair competition from VIA Rail (especially in the Toronto–Ottawa–Montreal triangle), because VIA Rail is highly subsidized by taxpayers. VIA Rail has been aggressive in its pursuit of market share in the shorter-distance, but higher-density markets. While its campaign has aimed in part at the air mode by emphasizing faster, more convenient and better service, VIA Rail also competes with the bus carriers through special discount fares. The bus industry believes that subsidized passenger rail service limits its ability to offer more and better services to bus customers. VIA Rail, on the other hand, argues that it pays for the infrastructure (stations and track) it uses, while buses do not pay for use of the roads.

The second major point was that the bus industry endorses the present regulatory regime, which restricts competition and allows profits to be generated on high-volume routes, but requires carriers to continue service on low-volume, unprofitable routes. The bus carriers argue that this system, with its cross subsidization, is necessary, if they are to provide service to smaller communities.

## GOVERNMENT POLICIES: PAST AND PRESENT

### REGULATION

Regulation of the intercity passenger bus industry in Canada was introduced by provincial governments in the early 1930s to stabilize the industry. In 1954, in response to a complaint by a bus company, the Supreme Court of Canada determined that the federal government was responsible for every bus and truck operation whose business was extra-provincial — that is, extending beyond a single province or territory.

Because the federal government had no legislation, administrative structure or expertise in place, Parliament enacted the *Motor Vehicle Transport Act* of 1954. This Act delegated federal responsibility for the economic regulation of motor-vehicle transport, including bus transport, to the provinces.

The *Motor Vehicle Transport Act, 1987* substantially deregulated trucking, but bus regulation was essentially unchanged. Provincial transport boards are to issue licences and regulate tariffs and tolls for extra-provincial bus operations ". . . on the like terms and conditions and in the like manner as if the extra-provincial bus undertaking were a local bus undertaking. . . ."[2]

Although all provinces and territories regulate bus carriers, there are differences in their manner of doing so. Eight of the provinces grant a bus company authority to operate a scheduled intercity service only if the applicant is able to prove public convenience and necessity. A public hearing is held if there are any objections to the proposed service. New Brunswick and Prince Edward Island removed this requirement in 1987, and now have a reverse onus test — an application is denied only if it is proven that the application would be detrimental to the public interest. In every province and territory, changing or abandoning a service requires approval by the provincial/territorial regulator.

Also in every province and territory, bus companies must file fares and obtain approval for them from the provincial/territorial regulatory authority. In Alberta, Saskatchewan, Manitoba and Newfoundland, only maximum fare levels require approval. All provinces and territories allow for public hearings to handle objections to fare increases. At the time of writing this report, the Maritime provinces were engaged in discussions that may lead to a common regulatory regime for intercity bus operations in New Brunswick, Nova Scotia and Prince Edward Island. It is expected that any common regime would be at least as open to competitive services as the relatively liberal regulation in New Brunswick and Prince Edward Island.

Charter services require separate licences in seven provinces. The reverse onus test applies to charter services in Alberta, New Brunswick and Prince Edward Island.

A number of scheduled bus services link Canadian and U.S. centres. These services are regulated by the provinces under the delegation of federal responsibility for extra-provincial carriers. They are also subject to U.S. regulation. U.S. federal regulation, which applies to interstate and international services, and the regimes of several of the states, less strictly control introduction of new services, changes in service, and pricing, than Canadian regulation.

### COMPETITION

Competition among bus carriers on the same routes is generally discouraged. While there are a few exceptions, the bus industry consists mostly of regulated intercity monopolies. Even overlapping routes, such as Greyhound's trans-Canada service and the provincial services of the Saskatchewan Transportation Company, do not usually compete for the same passengers.

## THE EFFECTS OF REGULATION

### CROSS SUBSIDIES

Cross subsidies help maintain service on low-volume routes. Regulation of fares and routes allows carriers to earn high returns on high-volume routes in exchange for an explicit or implicit commitment to provide service, below cost if necessary, on other routes. Our analysis, based on average costs and revenues for various route types, suggests that:

- The most lucrative express routes could make a profit equal to half of the average fully allocated costs including return on investment.
- Mixed services (where intercity passengers are carried, but stops are also made at small communities) and long-distance services are generally profitable.
- Some local routes that parallel express service between major urban centres recover less than 25 percent of their costs.

### OTHER EFFECTS

Regulation has its drawbacks. Our analysis suggests that average intercity bus transportation costs are higher than they would be in a more open market, in part because of lower efficiency. As discussed earlier, the bus industry has been losing market share, and is highly concentrated and regionalized. A policy that provides greater room and stimulus for a more entrepreneurial approach offers the possibility of improving bus service where it has the greatest potential.

## THE CASE FOR A COMPETITIVE BUS INDUSTRY

Would opening the bus industry to competition result in a healthier industry, lower fares and improved services for travellers?

The experience in the United States and the United Kingdom offers useful insights. The United States and United Kingdom started regulating their intercity bus industries more than 50 years ago, in 1935 and 1930, respectively, and substantially deregulated them half a century later within a span of 22 months.

### THE U.S. EXPERIENCE

In 1982, the U.S. Congress substantially, but not totally, deregulated intercity bus services. Some states have followed suit.

The major carriers have experienced financial difficulty and reorganization. The general economic malaise in the U.S. intercity bus industry was evident before 1982. The cost reduction achieved through franchising, renegotiating wage contracts, changing work rules, and eliminating unprofitable routes (which was possible because of regulatory reform) was not enough to stop the downward trend.

A major development after regulatory reform in the United States was the Greyhound-Trailways merger. Greyhound in the United States (which does not have a corporate relationship with Greyhound in Canada) now controls 85 percent of the revenues generated by the major interstate bus companies. It provides the only public intercity transportation in 9,000 of the approximately 9,500 markets it serves.

The Greyhound-Trailways merger has resulted in service to rural communities that operates like the airlines' hub-and-spoke system. Small carriers affiliated with Greyhound use vans to provide service in areas where demand is insufficient to warrant using full-size buses. These so-called "feeder lines," which are linked to communities served directly by Greyhound, are operated by independent entrepreneurs who act as agents for Greyhound and receive a portion of the fare.

There is no question that there has been reduction in the availability of intercity bus service to small communities by the major bus companies; but much of this would have occurred in any event. Bus ridership, routes and service points were decreasing prior to regulatory reform.

## THE U.K. EXPERIENCE

In the United Kingdom, regulatory reform was more extensive than in the United States. British intercity bus travellers have benefited, on average, from lower fares and improvements in the quality of service.

One of the effects of deregulation was reorganization and concentration within the express-bus sector. Six major private companies combined to compete with the publicly owned National Express, but failed. Within four years of regulatory reform, National Express, which was privatized in 1987, had become, once more, a monopoly supplier on many routes where private operators had initially offered new service. While National Express has recaptured the market on most routes, the threat of new companies entering the market appears to have kept fares from rising.

As in the United States, there was some reduction in lower-volume bus services after regulatory reform. Discontinuing intercity services, however, appears to have denied few people access to adequate intercity transportation.[3] Local authorities have provided subsidies to prevent loss of the services that link rural areas and small communities to larger urban centres. These services have, in general, been operated by private-sector bus companies and have achieved cost reductions.

## COMPETITION AND LOWER FARES

Our research indicates that there would be advantages to travellers if the Canadian bus industry faced more competition. In a more open market, carriers would rationalize services and trim costs or lose market share on profitable routes to lower-cost competitors. Easier market entry would invite innovative services that could reverse, or at least slow down, the current decline in bus ridership.

Competition or potential competition on higher-volume routes should lead to lower fares. Because carriers would be deprived of exclusive rights, fares for express services, even between cities of moderate size, should fall. International experience supports this conclusion, as do the results for one of the few routes in Canada where competition exists. Greyhound currently competes in Alberta with Red Arrow's luxury service between Calgary and Edmonton and between Edmonton and Fort McMurray. Fares on these routes are lower than on similar routes.

On short low-volume routes where fares currently fall well below costs, and where competition is unlikely, fares would be expected to rise after removal of regulation. This would contribute to keeping some of the routes viable.

## INNOVATION

Relaxed economic regulation would encourage innovation and entry of new operators into some markets, and more carriers in a market should increase service choice. Intermodal connections and innovative management techniques would be encouraged by a more competitive environment. Mini-bus operations and a variety of part-time ventures offering scheduled service would replace inefficient full-sized coach services to some smaller communities.

Large carriers would not necessarily force smaller operators out of business. Our studies indicate that large carriers do not always have the lowest operating costs. In fact, the costs per unit of service of some of the small and medium-sized carriers were among the lowest of those we studied. Some small carriers operate profitable rural services in markets that larger regional carriers have chosen not to serve.

Therefore, we **recommend** that:

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**13.1 The *Motor Vehicle Transport Act, 1987* and relevant provincial and territorial legislation be amended to substantially relax the economic regulation of buses to:**

- **(a) reduce the restrictions for entry to "fit, willing and able" criteria;**
- **(b) require that route abandonments be subject only to adequate public notice;**
- **(c) require only the publication of schedules and fares; and**
- **(d) ensure that carriers be subject to the *Competition Act*.**

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Our recommendation is addressed both to the federal government, regarding extra-provincial bus carriers, and to provincial/territorial governments, regarding remaining carriers. We note that extra-provincial carriers currently account for a large share of total passengers carried, and that other carriers could opt for extra-provincial status by extending their operations beyond a single province or territory. Thus, federal action would have the effect of deregulating most of the industry. To implement the recommendation, the federal government could withdraw its delegation of powers to the provinces/territories, or it could negotiate new agreements whereby provincial/territorial regulatory boards continue to enforce a modified motor vehicle transportation act with which we hope provincial/territorial regulatory regimes would be in harmony. We prefer the solution that creates the simplest administrative procedures for the carriers.

## COMPETITION LEGISLATION AND ENFORCEMENT

The success of relaxing economic regulation of intercity busing will depend on competition developing in the present regional monopoly markets. Such competition may come from large bus operators expanding into each other's traditional markets. We expect that charter carriers and small local operators that presently connect with the large monopoly carriers may also prove to be significant long-term competitors.

Potential competitors must be confident that federal competition legislation will ensure them a fair opportunity to compete and protect them from monopoly practices. The present *Competition Act* is a substantial advance over its predecessor, but the federal government should assure itself that the Act provides sufficient response and redress procedures to encourage active and effective competition in a newly deregulated bus industry.

We understand that protection for the small carriers that extend operations into the routes and terminals dominated by larger carriers would fall within the "abuse of dominant position" and the "refusal to deal" provisions of the Act.

We recognize also that competition policy applies to other sectors of the economy as well as transportation, and that the federal government must consider a range of factors, including jurisdiction, that we are unable to assess. Nevertheless, if Canadian travellers are to gain the full benefits of relaxed economic regulation, potential entrants into transportation markets must not be discouraged by fears of monopoly practices on the part of well-established carriers.

Therefore, we **recommend** that:

**13.2 The federal government review the *Competition Act* and related policy and, if required, strengthen the powers needed to prevent anti-competitive practices in the intercity bus industry.**

## SERVICE TO SMALL COMMUNITIES: THE TRANSITION

We are concerned about the impact of regulatory reform on services to small, rural communities. Some communities will enjoy reduced prices and better service because bus companies will use more suitable equipment for the market and reduce their costs. In less populated regions, smaller and older buses and part-time operators with mini-vans will enter the bus business, as is common in Newfoundland.

Fares for shorter rural trips could rise with reduced regulation. Some rural routes would survive, but with reduced frequency. Some communities would no longer be served by major carriers with full-size coaches. Others could lose scheduled service if there is very low demand for bus travel.

We believe that, after a period of adjustment, small communities that provide a regular travel market will be served. Experience and our studies indicate that bus operations can be viable in quite small markets. Regulatory reform frees the market and allows each carrier to choose to operate any route or type of service based on its commercial interests. The result is that services appropriate to the size of the market emerge.

We believe that bus travellers on profitable routes should not have to subsidize travellers on unprofitable routes. Bus riders on profitable rural and intercity routes are often those who cannot afford any other mode of travel. These bus riders should not pay extra to provide transportation on unprofitable routes.

We recognize that transition provisions may be required so that bus service in some areas is not lost while the industry adjusts.

Therefore, we **recommend** that:

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**13.3 If necessary to avoid steep increases in bus fares on particular routes following the relaxation of economic regulation of the intercity bus industry, transition subsidies be provided on a declining basis not to exceed 10 years and then terminated, with such subsidies being provided on a competitive tender basis to the carrier that can provide a safe service at the lowest cost, and being paid for by taxpayers in those jurisdictions that wish to maintain the service.**

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In recommending reduced regulation of market entry and exit, we considered a gradual transition to an open market that would allow carriers time to reorganize and reduce costs.

We have decided, however, not to recommend such a transition period. Our reasons are as follows:

- The legislative amendment process will take a substantial period of time, and there will be additional delays before the new provisions come into force.
- One change is sufficient. Carriers and travellers should not have to adapt to a transition regime, only to change again when the transition period is over.
- Some parties may be tempted to manipulate a transition regime to position themselves for a competitive advantage later. A transition period could foster anti-competitive practices.

The bus is the lowest cost way of transporting Canadians to where they want to go. With deregulation of the intercity passenger bus industry, bus travel would become more efficient and even less costly.

# ENDNOTES

1. Russell's Guides, Inc., *Official Canadian Bus Guide,* May–June 1991.

2. The *Motor Vehicle Transport Act, 1987* provides authority for the federal government to exempt a bus carrier from falling under provincial jurisdiction. Such exemption means that the carrier is regulated under the provisions of Part IV of the *National Transportation Act, 1987* and falls under the jurisdiction of the National Transportation Agency. (The corresponding provision in the earlier Act was invoked only once, as a consequence of a dispute between CN Roadcruiser and the Board of Commissioners of Public Utilities of Newfoundland. The Board had restricted the tariff of the federally owned replacement for Newfoundland's passenger rail service.)

3. European Conference of Ministers of Transport, *Regulatory Reforms in the Transport Sector,* Paris, 1988, p. 13.

# CHAPTER 14

# APPLYING THE PRINCIPLES TO FERRIES

## INTRODUCTION

Canada has the longest coastline of any country in the world and has major island groupings in temperate climatic zones — including three on which provincial capitals are located. Inland, the St. Lawrence River and the Great Lakes are two of the country's and the world's major waterways. In the past, when it was easier to travel by water than overland, towns developed along Canada's waterways. Today, water transportation continues to be an important mode of travel for many Canadians.

Ferries provide a variety of passenger transportation services to many Canadians. The operators providing these services range from small to large; some are privately owned and some are publicly owned. For example, the British Columbia Ferry Corporation (BC Ferries), with 38 ships and 24 routes serving 43 terminals, is one of the world's largest ferry services.[1] In contrast, river-crossing ferry services for short distances between two points are provided in many locations by small operations. The variations in ferry services across Canada are as great as the variations in Canada's geography and population distribution.

Taxpayers provide substantial support to ferry services. Measured in costs per passenger-kilometre, ferries are the second most heavily subsidized means of passenger transportation, after rail. Since Confederation 125 years ago, federal and provincial taxpayers in Canada have spent large amounts of money on ferry services. The reasons for these expenditures include meeting constitutional obligations (for example, the provision of ferry service to British Columbia, Prince Edward Island and Newfoundland) and encouraging social or economic development, particularly in Atlantic Canada.

The major intercity ferry operations in Canada are found on the west and east coasts. Most of the ferry routes on the west coast are operated by BC Ferries, a provincial Crown corporation. Marine Atlantic Inc., a federal Crown corporation, provides the majority of the ferry services on the east coast. Other larger ferry services include: the seasonal service between Prince Edward Island and Nova Scotia, operated by the privately owned Northumberland Ferries Ltd.; the St. Lawrence River ferries, operated by the Quebec government; and the Great Lakes service, operated by the Ontario government.

Passenger volume on these ferries varies a great deal. In 1990, BC Ferries carried nearly 20 million passengers,[2] Marine Atlantic carried almost 2.5 million, and Northumberland Ferries approximately 530,000.[3] The next two largest services are: the Matane to Godbout to Baie-Comeau route of the Société des traversiers du Québec, which carried approximately 270,000 passengers in 1990;[4] and the Ontario Northland Transportation Commission's Tobermory to South Baymouth service, which carried over 200,000 passengers in the same year.[5]

Overall, the use of ferry services in Canada has increased in recent years. Most of the increase has occurred on the west coast, where BC Ferries carried a total of 18 million passengers in 1986 and 20 million in 1990. On the east coast, Marine Atlantic's total ridership grew slightly, from 2.3 million passengers in 1986 to 2.5 million in 1990.[6]

There are many different types of ferry services. The following are a few examples:

- The MV *Joey and Clara Smallwood,* a large ferry equipped with a modern navigation system, travels 519 kilometres between North Sydney, Nova Scotia, and Argentia, Newfoundland, twice a week. In 1991, this ferry carried about 15,000 vehicles and 41,000 passengers during its late-June to early-September operating season.

- A high-speed passenger-only ferry service (catamarans travelling at speeds of up to 37 knots) operates in the Georgia Strait between downtown Victoria and downtown Vancouver. The vessels used on this new service can carry up to 312 passengers.
- A privately owned and operated ferry service crosses the Ottawa River between Cumberland, Ontario, and Masson, Quebec, a distance of less than a kilometre. The ferries in this service can carry 13 cars, operate 24 hours a day year-round, with at least 2 ferries in the winter and up to 5 in the summer, and offer 5-minute service during the day and 10-minute service at night.

Many of the shorter ferry services could be described as intercity. These include such routes as Cumberland to Masson as well as the Quebec City to Lévis and Halifax to Dartmouth routes. As well, there are services on both coasts that connect small, remote communities, most of which are completely dependent on these ferries for both freight and passenger service. For the purposes of this report, however, we have focussed on longer intercity trips that are more comparable with intercity trips in other modes.

## WHAT CANADIANS TOLD US

Interveners from the Atlantic region told us that their ferry operations provide essential passenger and cargo services. They argued for increased federal presence and funding to establish more year-round ferry services in the Atlantic provinces. They pointed out that ferry service is an important tool for economic development, both in the role it plays in the tourism industry and as a means of moving freight.

Several interveners urged us to consider ferry service as an integral part of the transportation system in the Atlantic region, rather than as a method for point-to-point travel. They said that ferry services are an extension of the highway and railway systems and recommended further integration of the various modes to enhance the ferry services.

Interveners from British Columbia also told us how important ferry services are to them. They pointed to the role that ferry services could play in a rapid-transit system connecting Victoria and Vancouver. They suggested these cities build rapid-transit systems that link with ferry docks to provide an inexpensive and environmentally safe method of moving large numbers of people (presumably without their cars). Some also suggested establishing local bus service to the ferry terminals because such services would have lower fares than those now charged for special bus service to the terminals.

Interveners emphasized the importance of ferries to tourism and asked for increased service between points in Canada and the United States. Some stressed that ferries should continue to serve remote communities even though such services require subsidies. Several interveners called for an increase in federal funding for British Columbia's ferry services to match that received by eastern Canada. In British Columbia, as in the Atlantic provinces, some suggested that ferry services should be considered as an extension of the highway system.

## CONSTITUTIONAL OBLIGATIONS

Some ferry services are part of early constitutional arrangements. Each of the Terms of Union signed between Canada and British Columbia, Prince Edward Island and Newfoundland included an obligation on the part of the federal government to provide a ferry link to the mainland.[7] In a few cases, the federal government has also agreed to subsidize alternative ferry routes to those set out in the Terms of Union, although no federal constitutional obligation exists for these. The alternative services include the seasonal service between Caribou, Nova Scotia, and Wood Islands, Prince Edward Island, operated by Northumberland Ferries Limited.

Courts and governments have reviewed constitutional obligations for modern transportation. When the federal and provincial governments negotiated these Terms of Union, ferry services played a different role in the lives of Canadians than they do today. Steamships provided ferry services, carried mail as well as passengers, and linked communities in a time of few roads and no air service. Over the years, the function and technology of ferry services have changed considerably. Today, ferries use many different technologies, and passengers can often choose other modes of transportation for many ferry routes. As a result, courts and governments have attempted to interpret constitutional agreements in a modern context.

## BRITISH COLUMBIA

The original federal-provincial agreement was intended primarily to ensure mail service. Under Term 4 of the 1871 *British Columbia Terms of Union*, Canada undertook to "provide an efficient mail service, fortnightly, by steam communication between Victoria and San Francisco, and twice a week between Victoria and Olympia [the capital of neighbouring Washington state]; the vessels to be adapted for the conveyance of freight and passengers." To fulfil its obligations, the federal government subsidized a private steamship operator under a contractual arrangement.

In 1925, the federal and provincial governments agreed that the service between Victoria and San Francisco no longer required a subsidy, and that the British Columbia government should use the subsidy to improve mail service within the province.

In 1977, the federal and British Columbia governments entered into a new arrangement for ferry subsidies.[8] The federal government agreed to pay a block grant of $8 million per year to the province to support ferry service. With annual adjustments to cover inflation, the estimated payment in 1992-93 is $19.9 million.[9] In return for the payment of this subsidy, Canada was "relieved of any and all obligations for the provision of subsidy or other financial assistance over and above the subsidy provided for in this Agreement."[10]

The province is responsible for how the federal grant is allocated and has agreed to "assure reasonable and adequate service and appropriate supervision thereof" in British Columbia coastal waters.[11] The province is also obliged under the agreement to "place appropriate passenger vessels in service . . . to give effective links where required on the coast between communities and principal water and air services."[12]

While the current agreement satisfies the requirements of the Terms of Union, the constitutional obligation to provide the service remains that of the federal government rather than the province.

## PRINCE EDWARD ISLAND AND NEWFOUNDLAND

The federal agreements with Prince Edward Island and Newfoundland ensured specific ferry routes. In 1873, Prince Edward Island joined Confederation with the assurance that the Dominion government would "assume and defray all charges" relating to a list of services, including what has become the ferry service connecting Prince Edward Island and New Brunswick.[13]

Term 32(1) of the 1949 *Newfoundland Act* provided that "Canada will maintain in accordance with the traffic offering a freight and passenger steamship service between North Sydney and Port aux Basques, which, on completion of a motor highway between Corner Brook and Port aux Basques, will include suitable provision for the carriage of motor vehicles."[14]

Marine Atlantic operates the two ferry services that fulfil Canada's constitutional obligations to these provinces. One service operates between Cape Tormentine, New Brunswick, and Borden, Prince Edward Island; the other, between North Sydney, Nova Scotia, and Port aux Basques, Newfoundland. Terms 32(2) and 32(3) of the *Newfoundland Act* limit the rates that can be charged for traffic to Newfoundland.[15] This is the only rate limitation for any constitutionally required ferry service.

The possibility of fulfilling the constitutional ferry obligation to Prince Edward Island by replacing the ferry service operated by Marine

Atlantic with a fixed link has been under consideration for several years. In the spring of 1992, in response to a federal government invitation, three developers submitted proposals to construct and operate for 35 years a fixed link between New Brunswick and Prince Edward Island. At the time of writing, all of these bids had been rejected as not complying with the federal government's requirements, and discussions were ongoing. The invitation for proposals provided that at the end of the 35-year period, the structure would become the property of the federal government and would be operated as an interprovincial bridge. During the intervening period, the federal government would pay the operator a predetermined amount that would be similar to the amount that the ferry subsidy at existing levels would have been, plus other avoidable costs of the service. Had our principles been adopted, however, the ferry subsidy would have been substantially lower and the proposed fixed link would only meet our investment criteria with a higher bridge toll.

## MARINE ATLANTIC AND BC FERRIES — COSTS AND REVENUES

The two largest ferry companies in Canada receive different levels of government subsidies.[16]

Marine Atlantic Inc.'s revenues totalled nearly $218 million in 1990. Of this amount, $147 million[17] came from federal taxpayers and the rest, $71 million, came from ferry passengers and freight.

The commercial portion ($71 million) of the total revenues came from fares and charges for other on-ship services, such as restaurants, and vessel and miscellaneous services. Charges for the direct movement of passengers and vehicles accounted for almost 78 percent of commercial earnings.

Of the federal payment ($147 million), $96 million was for direct operating expenses (excluding any allocations for administrative or capital costs). Approximately 60 percent of this latter amount was for the two constitutionally required services ($22.7 million for the Prince Edward Island service and $36 million for the Newfoundland service).

BC Ferries' revenues totalled $242 million in 1990. Of this amount, $229 million came from commercial revenues, including tolls for passengers and vehicles, and catering and other income, and $13 million came from British Columbia taxpayers as an operating subsidy.[18] Passenger-transportation-related revenues accounted for almost 81 percent of commercial revenues.

In addition to operating revenues, various forms of capital assistance are provided by federal taxpayers to Marine Atlantic and by British Columbia taxpayers to BC Ferries.

There are large differences in average costs for the two ferry companies. Average passenger costs for Marine Atlantic are approximately double those of BC Ferries. Average passenger costs, however, for BC Ferries' services, excluding the services between Vancouver Island and the mainland, are similar to those for Marine Atlantic's operations. Some of the reasons for the large differences in average costs are as follows:

- BC Ferries has a more even distribution of annual traffic than does Marine Atlantic. Peak season activity represents about 40 percent of total annual passenger traffic for Marine Atlantic, but only about 22 percent for BC Ferries.[19] Marine Atlantic vessels are constructed to handle this peak season traffic and therefore have unused capacity in the off-season. In contrast, more even year-round operation allows BC Ferries to make fuller use of its vessels.
- Marine Atlantic has higher costs because its vessels must be ice-strengthened for winter conditions. Ice strengthening increases initial capital costs and, as a result of the added vessel weight, operating costs increase as well. BC Ferries, however, operates primarily in the southern part of the province, where weather conditions are less severe. This results in fewer capital-intensive shore facilities, lower vessel operating expenses and fewer cancellations because of bad weather.

- Wage rates do not contribute to Marine Atlantic's higher operating costs. Labour costs are 44 percent of Marine Atlantic's total operating costs, and 55 percent of BC Ferries'. In addition, BC Ferries' wages are, on average, 11 percent higher than those of Marine Atlantic. Administrative costs do not differ substantially between the two operators — they represent 11.6 percent of Marine Atlantic's total costs, and 14.3 percent of BC Ferries'.

## THE PRICING OF FERRY SERVICES

In Chapter 4, we recommended that travellers pay the full costs of the transportation services they use and that carriers pay the full cost of the terminals, links and traffic control services they use. Thus, passengers (and freight shippers) should pay the full costs of the ferry services that they use, and operators of ferry services should charge travellers the full costs of providing their service, including the costs of the provision of terminals, harbour fixtures and navigational aids.

Any additional costs imposed on ferry operators because of government requirements (such as requirements to purchase local or Canadian manufactured goods or equipment or to have maintenance or refitting of vessels carried out at specific locations) should be clearly identified. These costs should be funded by the government concerned, out of the appropriate industrial or regional development budget, and should not be included as part of the costs to be recovered through fares.

In addition, in Chapter 4 we recommended that terminals, links and traffic control services be individually priced on a terminal-by-terminal, link-by-link and service-by-service basis. The nature of a ferry service allows each service or link to be priced individually.

We realize that the goal of full payment of costs cannot be achieved immediately, but, from this point on, governments should use this goal when setting policy, making transportation investments, and looking at future programs and projects. Avoidance or minimization of subsidies on existing services results in a more favourable environment for introducing innovative services. The new high-speed ferry service introduced early this year between Victoria and Vancouver is an example of what can happen in a free market. It competes with a BC Ferries' service that receives little or no subsidy.

We recognize that, for some routes, ferry rates would have to increase considerably (more than 10 percent annually) to achieve financial self-sufficiency within the next 10 years. In other cases, ferry rates are already at, or near, cost-recovery levels.

Table 14-1 compares the rates charged on routes of similar length for Marine Atlantic and BC Ferries. The figures show that:

- Marine Atlantic's one-way fare per kilometre for the shortest route shown is higher than for a similar length route operated by BC Ferries;
- one-way fares per kilometre on the longest routes differ substantially on the east and west coasts; and
- fares on medium-length routes also vary. On the east coast, the Yarmouth to Bar Harbor route is almost the same length as the North Sydney to Port aux Basques route, but its one-way fare per kilometre for a passenger is nearly three times as much in the peak operating season. The fare differential is less in the case of the one-way fare for a car and driver. Both routes are operated by Marine Atlantic. BC Ferries' fare for a comparable-length service from Prince Rupert to Skidegate is similar to that for Marine Atlantic's North Sydney to Port aux Basques route for a passenger, but nearly one-third more for a car and driver.

In the transition to ferry services where travellers pay the full costs of the services they use, ferry operators will have to raise rates and/or reduce costs on most routes. We realize that such adjustments will take time.

*Table 14-1*

*SELECTED FERRY RATE COMPARISONS, MARINE ATLANTIC (M.A.) AND BC FERRIES (B.C.), 1992*

| Service | Crossing distance (km) | One-way fare auto and driver ($) | Fare/km auto and driver ($) | One-way fare passenger ($) | Fare/km passenger ($) |
|---|---|---|---|---|---|
| Cape Tormentine to Borden (M.A.) | 15 | 11.75 | 0.78 | 3.25 | 0.22 |
| Horseshoe Bay to Langdale (B.C.) | 18 | 12.75 | 0.71 | 2.75 | 0.15 |
| North Sydney to Port aux Basques (M.A.) | 178 | 66.00 | 0.37 | 16.00 | 0.09 |
| Yarmouth to Bar Harbor (M.A.) | 185 | 120.00[a] | 0.65 | 45.00[a] | 0.24 |
| Skidegate to Prince Rupert (B.C.) | 172 | 82.00 | 0.48 | 17.00 | 0.10 |
| North Sydney to Argentia (M.A.) | 519 | 145.00 | 0.28 | 45.00 | 0.09 |
| Bear Cove to Bella Bella to Prince Rupert (B.C.) | 507 | 260.00[a] | 0.51 | 85.00[a] | 0.17 |

**Sources:** BC Ferries and Marine Atlantic Inc.

**a.** Peak-season rate.

**Note:** Peak-season fares shown where applicable.

Therefore, we **recommend** that:

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**14.1 Governments, in eliminating the capital and operating subsidies on individual ferry routes (including, where possible, the routes provided under the Constitution), establish transitional periods not to exceed 10 years in those cases where moving to immediate cost recovery would result in steep annual fare increases.**

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We also recognize the constitutional obligation of the federal government to ensure that adequate service continues to Prince Edward Island and to Port aux Basques, Newfoundland, and the constitutional limit on rates for the Newfoundland service. Wherever such routes require subsidies to cover costs, we believe that governments should ask the following:

- Are the fares appropriate?
- Is the operation furnishing services of sufficient benefit to justify continuation in its current form?
- Are there adequate pressures to achieve cost savings?

It may be possible, with increases in rates and cost reduction, that a constitutional service can be financially viable. Under those circumstances we think that is what should happen. We also recognize that, even with the most cost-effective service, and with rates that maximize revenues (subject to any constitutional fare constraint), traffic volumes may be such that a deficit might still be the case and, given the constitutional obligation, the federal government would have to continue to meet it.

In reviewing the options for moving toward elimination of the subsidy, the federal government should consider whether contracting out the provision of service, with fares ultimately to be set by the operator but with the transitional subsidy, would be cost effective. In this case, the tender could also provide for the operation of government-owned vessels for several years.

Keeping the above in mind, we **recommend** that:

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**14.2 In the case of those ferry services provided as a result of constitutional obligations, the governments concerned reassess arrangements and implement one of the following options:**

**(a) phasing down the capital and operating subsidy over 10 years to the minimum level consistent with continued operation of the service and with any other constitutional constraints; or**

**(b) offering a federal grant to the affected province in lieu of the subsidy. Such a grant might be based on the least-cost method of meeting the constitutional commitment. This would allow the province to decide if subsidizing ferry service was the best use of the funds.**

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To encourage an appropriate balance between fare increases and cost reduction efforts, we suggest that users of subsidized ferry services be given opportunities to advise the ferry operator on costs and fares. In providing their advice, we ask them to recognize the subsidy constraints faced by the operator and the need for procedures to achieve full cost recovery, or reduction or elimination of services.

In addition, we **recommend** that:

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**14.3 Where a ferry service provided as a result of a constitutional obligation is commercially non-viable, taxpayers provide the subsidy — not users of other ferry services through cross subsidies.**

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Those responsible for making and applying the rules and spending the taxpayers' money should be accountable for their actions. If government decides to continue subsidizing a ferry service, for whatever reason (for example, regional development), the decisions should be transparent, that is, visible and up-front.

Therefore, we **recommend** that:

**14.4 The amount of, and reason for, any subsidy for a ferry service be clearly reported.**

# ENDNOTES

1. British Columbia Ferry Corporation, *Annual Report 1990-1991*, p. 3.

2. Two of BC Ferries' most highly used routes carried more passengers than did the other systems combined. These are the Tsawwassen to Swartz Bay and the Horseshoe Bay to Nanaimo routes, which carried approximately 5.9 million and 3.8 million passengers, respectively, in 1990.

3. Geoplan Consultants Inc., *Canadian Ferry Costs and Industry Analysis*, a report prepared for the Royal Commission on National Passenger Transportation, RR-09, December 1991.

4. Société des traversiers du Québec, *Rapport d'activités, 1990-1991*, Table 1.

5. Ontario Northland Transportation Commission, Planning and Development Office.

6. Geoplan Consultants Inc., Tables 3.1, 4.1 and A.1 to A.5.

7. For a more detailed discussion, see Patrick J. Monahan, "Transportation Obligations and the Canadian Constitution," in Volume 3 of this report.

8. See Transport Canada, "Subsidy Agreement between the Government of Canada and the Government of the Province of British Columbia," April 18, 1977.

9. Transport Canada, *1992–93 Estimates, Part III, Expenditure Plan* (Ottawa: Supply and Services Canada), pp. 3-30.

10. Transport Canada, "Subsidy Agreement," section 5.

11. Ibid., section 4(2).

12. Ibid., section 4(3).

13. The relevant term in the *Prince Edward Island Terms of Union* provided for: "Efficient Steam Service for the conveyance of mails and passengers, to be established and maintained between the Island and the mainland of the Dominion, Winter and Summer, thus placing the Island in continuous communication with the Intercolonial Railway and the railway system of the Dominion."

14. *Newfoundland Act*, R.S.C. 1985, Appendix II, no. 32.

15. The wording of these terms is as follows:

    32(2) For the purpose of railway rate regulation the Island of Newfoundland will be included in the Maritime region of Canada, and through-traffic moving between North Sydney and Port aux Basques will be treated as all-rail traffic.

    32(3) All legislation of the Parliament of Canada providing for special rates on traffic moving within, into, or out of, the Maritime region will, as far as appropriate, be made applicable to the Island of Newfoundland.

16. This section is based on the report by Geoplan Consultants Inc. entitled *Canadian Ferry Costs and Industry Analysis*.

17. The total of $147 million includes $26 million that is shown as depreciation. The federal government funds Marine Atlantic's capital requirements directly. Depreciation is shown to reflect a capital cost on the assumption that depreciation, in the long run, will equal capital advances.

18. The financial assistance provided to BC Ferries by British Columbia taxpayers is applied initially to cover any operating loss and, secondly, to a capital subsidy account. From 1989 to 1991 the provincial government provided $51 million annually. Since 1991, the annual subsidy amount has been negotiated by the province and BC Ferries, and has been reduced somewhat for 1992.

19. Peak season activity is defined as the volume of passenger auto equivalents moved in July and August. A passenger auto equivalent is used to measure deck space utilization to allocate costs to freight and passenger movements.

# CHAPTER 15

# INTEGRATING THE MODES

## INTRODUCTION

As part of our mandate, the Government of Canada asked us to inquire into and report upon a national intercity passenger transportation system that would be integrated. In our Interim Report we noted that, "For some Canadians, the ideal passenger transportation system is one that integrates different modes of transportation. . . . Many Canadians would like to choose between a variety of modes of travel for a trip and be able to move between these modes easily."

Canadians spoke to us about three types of intermodal connections that they consider desirable:

- multimodal terminals — that is, terminals shared by several modes;
- improved linkages from terminals to downtown or home, including baggage handling; and
- integrated reservation and ticketing systems, including multimodal travel packages.

## INTEGRATION TODAY

In Canada, with rare exceptions, the only form of intercity transportation that takes people and their luggage directly from home to destination is the car. Rail, airplane, bus — all rely on each other or on the car to deliver most travellers to their destinations. Virtually all the terminals of the public modes are designed around the car.

There are many other reasons for the limited integration of public intercity passenger transportation. To some extent, the problems of intermodal passenger transportation result from governments having introduced safety and economic regulations along modal lines. While such regulations make administrative sense for technologies and markets, they have tended to keep the modes apart. Also, integration is held back because carrier managers do not want to be dependent on other modes whose operations they may not fully understand or with which they are in competition.

We believe that intermodal connections for public passenger transportation can be improved. We note the way freight is transported in Canada, where we see an industry with increased integration and competition among intermodal services. Rather than operating in isolation, the modes that handle freight cooperate extensively to offer shippers convenient and speedy service. The smooth flow of goods depends on a network with good connections between modes, and on sophisticated management, including computerized capacity scheduling.

So what is causing the lack of integration in the passenger transportation system? In our study of intermodal transportation, we found some good examples of integration, some examples where the missing link between modes is simply lack of information on schedules and tickets, and others where the lack of coordination is not logical. We examined these situations and others, focussing our attention on those aspects of passenger transportation that might inhibit intermodal cooperation: regulatory restraints, industry reluctance, lack of government cooperation or planning, and gaps in transportation infrastructure (such as rail tracks that run right by airports but do not connect with terminals).

To be successful, intermodal connections require cooperation among carriers. Two operators of different modes sharing a terminal, but operating independently and with no effort to coordinate schedules or ticketing, are not achieving intermodality. A network of several modes with a common reservations system, common ticketing, coordinated schedules and effective transfers of people and baggage between modes may integrate successfully without sharing a terminal.

Carriers tend to favour intermodal connections when the modes complement one another (intercity buses connecting with urban transit, for example) but dislike intermodal connections when the modes compete with each other (intercity buses competing with intercity rail, for example).

***Canada's Busiest Intercity Passenger Service is Intermodal***

**The 44-km BC Ferries service between Victoria (Swartz Bay) and Vancouver (Tsawwassen) carries six million passengers annually. Many of these are car travellers while others make the full trip by bus. But others find it convenient to travel by car, then ferry and then bus. The bus service also connects (via a suburban hotel) with a shuttle service to Vancouver airport.**

**Bus tickets may be purchased aboard the ferries, and foot passengers who indicate their intention to continue by bus may deposit their luggage as they enter the ferry terminal. Their baggage is then transported to the bus by ferry staff for delivery at the passenger's destination bus terminal.**

## AIRPORTS — MOST INTEGRATION OCCURS HERE

In Canada, the most common form of intermodal integration is ground transportation at airports. Airports are usually located far from central business districts and urban transit systems. Making airports more accessible to passengers is thus a challenge. At Transport Canada airports, the rights to provide ground transportation are sold through competitive tender.

Private cars account for the largest proportion (65 percent)[1] of airport passenger arrivals and departures. Some travellers are dropped off and picked up; others park at the airport. Five percent of travellers rent cars at their destination airport.

Taxis and limousines provide convenient service to and from airports, but are the most expensive mode of public ground transportation. Nationally, they account for 15 percent of arrivals and departures. In general, taxi fares are regulated and taxis either pay the airport for the right to pick up passengers, or Transport Canada charges the local government for the costs to the airports associated with taxi operations. As an example of the former, Transport Canada charges over $4,000 annually per taxi for an airport taxi permit at Toronto's Lester B. Pearson International Airport. Due to the restricted number of permits, each has a market value in excess of $40,000. At Calgary, however, the city pays the airport for all taxi-related costs, which are estimated to be about $60 per taxi per year and any Calgary taxi may operate to and from the airport.

Taxis with municipal licenses may take passengers to airports; Transport Canada licenses taxis to pick up passengers from the airports. In cases where not having both licences causes taxis to make the return trip empty, the cost of taxi service is increased. Some hotels provide guests with courtesy vehicle service. These vehicles, which carry about 5 percent of passengers, pay airport licence fees equal to about one third of those charged to taxis.

Municipal buses providing links to central business districts are the cheapest form of ground transportation at airports. Airport employees are the predominant users of the local bus services (at Pearson, about a fifth of them do so). These buses, which carry a very small percentage of air passengers, are part of the municipal transit system and do not generally pay airport fees, nor do they handle baggage. Express bus services, which are licensed by Transport Canada, are generally used by passengers (about 5 percent), are more expensive and provide baggage service.

Out-of-town ground services, which include door-to-door vans and intercity buses, carry about 5 percent of airport passengers. Provincial boards regulate entry and the level of fares for these services. A Transport Canada permit, for which a concession fee may be charged, is also necessary.

### ***Exclusive Concessions at Transport Canada Airports Reduce Competition***

**In 1991, Greyhound Lines of Canada applied for a permit to serve Calgary airport, which is owned and managed by Transport Canada. Their application stated that the company could provide airport passengers with convenient connections, via Greyhound's other routes, to neighbouring communities.**

**Transport Canada rejected the Greyhound proposal, deciding that the existing shuttle service to downtown Calgary, provided by a local carrier, was satisfactory.**

Airport-to-rail intermodal connections do not exist, except to a limited extent at Montreal's Dorval airport, or via a bus link as in Toronto.

Many of these services suffer from a lack of visibility at airports, and information on schedules and fares is not always easy to find. Baggage handling and pre-boarding clearance are rare. Cash is often the only means of payment, and through ticketing is usually unavailable.

When we examined the charges for ground transportation at Transport Canada airports, we found that they are inconsistent with the department's cost-recovery policy for federal airports. Given their revenue objectives, it is logical that airport management favours private operators (which pay for concessions) over public buses (which do not). What seems inconsistent is that, at Pearson, while taxis without airport licences are charged a fee for a pre-arranged pickup, there is no charge to private cars for pickup and drop off of passengers. This situation is not exclusive to Pearson. At other airports, different means are used to charge for access by taxis and buses, but no fee is charged for access by private cars. Since urban buses pay no airport fees, they receive the lowest priority for platform accessibility.

### *Many Connections at Pearson Airport*

About 42,000 passengers arrive at, or depart from, Toronto's Lester B. Pearson International Airport every day, using different modes of transportation:

*Car:* Approximately 28,000 travellers use private vehicles. The airport provides 9,500 parking spaces supplemented by private off-site parking with shuttle-bus service.

*Toronto transit:* Three urban bus routes connect through the airport, each with two or three departures hourly, some linked to the subway system.

*Taxis, limousines, vans and intercity buses:* 550 taxis and limousines and 14 door-to-door van services and intercity bus companies offer scheduled and non-scheduled service to more than 50 centres throughout southern Ontario.

The public carriers serving communities beyond the Toronto metropolitan area are members of the Airport Ground Transportation Association, which coordinates the flow of the carriers and their passengers. The airport permits access to all public carriers who have the approval of the provincial or city regulatory authority, subject only to availability of space.

*Rail:* Governments earlier concluded that rail, as a stand-alone system, would not be economically viable. They are once again studying a rail link as part of the regional (all modes) transportation network. Rail connections via the express bus are available.

Leisure travel is an example of carriers cooperating to provide intermodal connections. In the leisure travel market, bimodal and even multimodal all-inclusive flight, cruise, bus and train packages are standard. Examples include air-rail excursions in the Windsor to Quebec City Corridor, air-rail-bus packages to the Rockies, and tours that include west-coast and Arctic cruises.

***Leisure Travel and Intermodal Connections***

- **Air Canada's Freedom Flyers promotion includes a seven-day Greyhound Lines of Canada pass.**
- **The Experience Canada coalition includes bus, rail and air carriers.**
- **Canadian Airlines International and VIA Rail offer fly-rail packages to foreign tourists.**
- **Canadian Airlines International and Brewster Transportation provide a fly-bus inclusive ticket price to Banff.**

## INTERNATIONAL COMPARISONS

In other countries, intermodal connections often involve considerable government funding and/or regulation. National railway monopolies dominate intercity public passenger transportation in Europe. For example, in France, the government intervened to ensure that a Train à Grande Vitesse (TGV) rail connection was developed at Charles De Gaulle airport. In addition, European governments often do not allow bus services to compete with train services.

In Germany, Frankfurt airport has instituted a central baggage handling system to maintain control over intercarrier baggage transfers and to improve the convenience of the airport as a transfer point between air and rail. The airport's system allows convenient integration of the government-controlled airline with the government-controlled rail system.

Many foreign airports are connected to cities through rapid-rail transit. For example, the U.S. government funds the "Metro" in Washington, D.C., which provides express subway service to Washington's National Airport. About 15 percent of airport passengers use this transit system. A new transit line to the Atlanta, Georgia, airport is used by 10 percent of air travellers to Atlanta as well as by airport employees.

## BARRIERS TO INTEGRATION

It was clear to us that Canadians want more integration of transportation, and that the current passenger transportation connections among modes are often not well developed. Is poor integration simply the result of competition among commercial carriers? For example, carriers see the other modes as competitors rather than extensions of their service. For this reason, bus carriers do not want their passengers to have easy access to trains and therefore resist the use of a common terminal.

### THE CAR

We concluded that there are many reasons for Canada's lack of an integrated passenger transportation system. For example, Canadians' extensive use of motor vehicles discourages public mode integration. If cars and taxis did not provide transportation to and from terminals, intercity operators would have to cooperate with local public transit to provide door-to-door service.

### THE GOVERNMENT'S ROLE

Both the *National Transportation Act* of 1967 and the *National Transportation Act, 1987* called for free competition among the modes. The 1967 Act promoted competition between public modes to create an "economic, efficient and adequate transport system." The 1987 Act expanded competition from among the modes to within the modes and, at least for the air mode, lessened regulatory burdens and simplified regulatory procedures. The legislation does not encourage cooperation among carriers of different modes.

### COMPETITION

Although market forces may not be sufficient to encourage integration among competitors, we note that where there are a number of carriers and regulation of access to the market has been relaxed, intermodal connections improve. Historically, links to rail have been more frequent where there were competing bus lines. As further evidence, deregulation of domestic air transportation encouraged new entrants and prompted major air carriers to integrate their schedules with subsidiary and allied feeder air carriers.

The airlines that made submissions to us expressed an interest in extending this type of integration to surface modes. In addition, VIA Rail has consistently expressed interest in bus-rail terminals, believing they would result in a net gain in traffic for VIA Rail. While air carriers are interested in better surface connections, market-entry regulations — particularly those for intercity buses — make it difficult for new operators to provide such connections.

## REGULATION

The tightly regulated intercity bus industry poses obstacles to integration. Provincial regulations have created intercity bus route monopolies. In addition, intercity bus companies have generally been opposed to convenient bus-rail terminals. They believe they would lose profitable passengers to rail and only pick up less profitable or unprofitable feeder traffic.

Restricted access of ground transportation to air terminals hinders intermodal connections and traffic growth. In general, airports limit such access in order to generate revenue from concession permit holders. We are concerned that the federal government's current airport revenue policy creates pressure to obtain income from permits, and does not encourage airports to create and expand a wide range of ground transportation. We hope that the new federal policy of turning the management of federal airports over to local authorities will have a positive effect. We expect that local managers may give more weight to their communities' needs, to passenger convenience and to encouraging growth in passenger volume.

At present, computer reservation systems are confined to two modes. VIA Rail subscribes to the airlines' computer reservation systems, but bus companies do not because they find them too expensive. Greyhound has introduced an automatic central telephone system that offers not only information on its own schedules and fares but also information on other bus companies in the continental network. Expanding such information systems to include all modes would be a step toward an integrated passenger transportation system.

## DISMANTLING THE BARRIERS

In Chapter 13, we recommend major regulatory reform of the intercity bus industry to permit competition within that mode. The result of these new opportunities might be a market comprising intermodal chains of cooperating carriers. These chains would compete with each other, providing convenient origin-to-destination, single-ticket service.

For many travellers, modal integration means the ability to make easy interconnections among the modes. This encompasses through ticketing, flow-through baggage handling and minimizing of the number of interconnections.

Many told us that they find it incredible that, through the action of governments, Mirabel airport was located so far away from any city, and with so few means of public access. In addition, many large airports such as Pearson and Dorval are not connected to urban subway networks or to nearby rail lines.

While some of these past decisions may not have been good, it would be extremely expensive to make the desired corrections. Interconnection projects should be evaluated in accordance with our principles. Those responsible for assessment should recognize that terminals alone do not achieve intermodality, that connections among competing modes generally require intervention by governments, and that costs, including common costs, must be properly charged to the various users of the transportation system.

Multimodal terminals are an obvious way to encourage integration. We note, however, that land costs have been a major consideration in the location of bus terminals, and local governments usually participate in deciding the location of urban terminals. Passenger rail stations are generally located near urban transit connections and offer practical starting points for multimodal rail and bus terminals.

Direct government intervention, involving access to public terminals and possible funding of construction, might support more intermodal cooperation. We believe, however, that there are more cost-effective ways to advance modal integration. The role of government as mediator and coordinator, but not necessarily as banker, needs to be emphasized. We urge that a greater role be played by governments at the local level. Reform of regulatory restraints, location of terminals, integration of capacity and design with urban development and zoning functions, and selection of suitable urban terminal designs are issues for local resolution.

## RECOMMENDATIONS: MOVING TOWARD INTEGRATION

Under our principles, we favour opening all transportation markets to competition, including providing for non-discriminatory access to transportation terminals. We believe that applying our principles to passenger transportation would substantially increase the availability and convenience of intermodal travel.

### ACCESS TO TERMINALS

While market forces alone are unlikely to cause the development of major intermodal terminals, we note that terminals built by government do not guarantee better intermodal services. Unless there are large cost-savings, dominant carriers resist sharing terminals with their competitors.

## *Government and Multimodal Transportation Planning*

### *Mirabel, Quebec*

Planners recommended that Montreal's international airport be located in Hudson Heights, Quebec. Highway access and commuter rail service to Montreal and Dorval airport were convenient, as were highway access and passenger rail service to Ottawa.

For a variety of reasons, however, the federal government built the airport in Mirabel, north of the Ottawa River. Builders included a commuter rail station within the airport terminal. Governments believed that a rapid-transit connection would counter the inconvenience of the airport location and further stimulate economic development of the region. The transit system, however, was never built. The commuter rail station is not used and now provides parking for airport employees.

### *Calgary, Alberta*

In the 1970s and early 1980s, Calgary planned to attract foreign tourists by integrating several modes of transportation in one terminal. Included would have been intercity bus passenger services, VIA Rail, the city's new light rapid-transit system and a shuttle bus to the airport with a check-in facility for airlines.

Two competing bus companies, Greyhound and Pacific Western Transportation, were eager to co-locate with VIA Rail but not with each other. When railway passenger service between Calgary and Edmonton was discontinued in 1986, Calgary's multimodal terminal planning ended.

### *Kitchener, Ontario*

When its city council agreed that a catalyst was needed to revitalize Kitchener's downtown core, an urban/intercity bus transportation centre was chosen. The province of Ontario paid $3.8 million of the $10 million cost for the 28 bay terminal with parking and provision for a shopping mall. This multimodal transportation centre was opened in 1988.

Some interveners argued for public investment in multimodal terminals, saying that more travellers would choose public modes if transfers were more convenient. Although we have not found evidence to support this argument, it may be true. We do not believe, however, that building a terminal guarantees its effective use.

Scheduled urban bus transportation that links airports to cities can be found in such centres as Vancouver, Winnipeg, Toronto, Ottawa and Montreal. Direct rapid-transit links do not yet exist at any Canadian airport, nor are dedicated urban express bus connections as developed as they are in other countries. In many cases, public transportation services from the nearest airport to small cities are either infrequent or non-existent.

Bus companies told us that if Transport Canada's exclusive airport concessions to taxi and bus operators ended, the result would be increased services by the intercity bus operators. In addition, airlines might operate their own feeder buses. For service between airports and smaller communities, multiple-passenger taxi services, perhaps semi-scheduled, might be viable if they could pick up and deliver at the airports and were allowed unrestricted intercity operation. Eliminating licences and exclusive franchises would not, of course, require eliminating all charges for motor vehicle access to an airport, but these charges should be applied on an equal basis to private cars, taxis and buses.

We believe that levels of government must work together to improve air and ground connections while local authorities assume management of major airports.

Therefore, we **recommend** that:

**15.1 Airport and municipal authorities cooperate to ensure unrestricted access to airports by all ground connectors who pay their share of the costs, and federal authorities grant all ground connectors open access to federally owned airports and rail stations.**

**15.2 All agreements for the sale or lease of federal transportation infrastructure include provisions that oblige the operating authority to grant open access to all intermodal connectors on equal terms and conditions.**

## ANTI-COMPETITIVE PRACTICES

Reducing regulations and removing impediments posed by differing regulatory jurisdictions may create a market dominated by one or two large, sophisticated carriers. We believe that our recommendations on open access would reduce the likelihood of a monopoly. We recognize, of course, that when competition is replaced with cooperation, dominant carriers, or a consortium of carriers, may gain market advantages and engage in anti-competitive practices.

In addition, transportation information technology, such as computer reservation systems, will play an important role in integrating passenger transportation services. Market forces will encourage the growth and development of these technologies, which, if controlled exclusively by one or two carriers, could lead to anti-competitive practices. How the government chooses to regulate against abuse by powerful data monopolies could influence future development of public intermodal connections.

Therefore, we **recommend** that:

**15.3 To give all modes the opportunity to compete and to cooperate on an equal basis, the federal government extend its regulations governing the anti-competitive practices of computer reservation systems beyond the air mode to take a multimodal approach.**

We believe that travelling Canadians would benefit from using intermodal connections and reservation systems that encourage cooperation and integration among modes.

# ENDNOTES

1. The 65 percent for cars and corresponding percentages for the other forms of ground transportation are approximate, judgemental estimates based on information from a number of individual airports but not on systematic, comprehensive data.

# CHAPTER 16

# SEEING INTO THE SYSTEM: ACCOUNTABILITY AND TRANSPARENCY

## INTRODUCTION

In Chapter 4, we stated that those responsible for making and applying transportation regulations and for spending taxpayers' dollars should be accountable for their actions. We said that governments can improve such accountability through transparency — making relevant information available and understandable. We further recommended that decision making be transparent so that Canadians can understand why choices are made.

In this chapter, we look at ways to improve accountability and to ensure that transportation expenditures and the reasons for making them are available to taxpayers and travellers. We are concerned with:

- what data are needed; and
- how the success or failure of the passenger transportation system can be judged.

## WHAT CANADIANS TOLD US

### WHAT THEY WANT TO KNOW

In our Interim Report,[1] we noted that Canadians had told us that they were not happy with the accountability and transparency of the passenger transportation system. They were not convinced that they were being told, with any accuracy, how their money was being spent, and they could not make a fair comparison between the travel modes because subsidies and costs were hidden within the system.[2]

In view of this, they wanted a more complete accounting of costs so that they could more adequately compare all modes, especially when considering large expenditures for new and improved infrastructure. They would also like a clear accounting of the subsidies paid by governments to the different modes of passenger transportation.

### OBSTACLES TO TRANSPARENCY

Many who spoke to us recognized the difficulties in calculating the subsidies to each mode. These difficulties occur because:

- multiple levels of jurisdiction subsidize travel;
- governments report investment expenditures on air, road and water infrastructure as annual expenses that are, in turn, mixed in with annual operating expenses; and
- social and environmental costs are hard to measure.

Canadians asked us to do our best to help them understand how much money is being spent and how the levels of government are spending tax dollars on each mode. They asked for a comprehensive accounting of costs that would enable them to better evaluate transportation choices.[3]

## ACCOUNTABILITY

### BENEFITS OF NEW INSTITUTIONS

#### A Better Accounting of Costs

In Chapter 6, we recommended new institutions for managing the passenger transportation system. These new institutions would improve accountability and transparency because they would develop accounts differently from those maintained by federal, provincial and territorial departments of transport, and would report income and expenditures in a more business-like way. For example, such institutions would regularly record investments in physical assets on a balance sheet — not as a current operating expense.

### More-Visible Subsidies

The new institutions would be separate from government and would have a corporate structure. The result would be that, if a government decided to finance an activity that does not pay its way, that government would have to make public any subsidies paid for that activity. For example, if a government decided to build a road that did not meet the investment criteria of the road agency, it would have to pay the road agency to undertake the project, and the subsidy would be visible to the public in the government's accounts.

Throughout our report, we have recommended that governments make public not only the amount of subsidies, but the reasons for providing them. We believe that such information is necessary if taxpayers are to hold their governments accountable.

## RECOMMENDATIONS FOR ACCOUNTABILITY

We also believe that, where agencies provide transportation infrastructure as monopoly suppliers, travellers and other interested parties should have a say in major decisions.

Therefore, we **recommend** that:

**16.1 Where an agency providing transportation infrastructure is a monopoly supplier, the level of government responsible for the agency create an advisory body of travellers and other interested parties to counsel management on investment priorities, charging mechanisms and appropriate charges for achieving financial self-sufficiency.**

Governments should be accountable in their roles as regulators and referees, as should government agencies who are monopoly suppliers of transportation infrastructure. Governments, therefore, must ensure that:

- objectives for such Crown corporations are clearly stated;
- information is available to allow taxpayers to assess the degree to which objectives have been met; and
- those responsible for making decisions are judged on their achievements.

## THE NEED FOR MORE AND BETTER INFORMATION

At present, there is a great deal of data available about Canada's passenger transportation system. During the course of our studies, however, we discovered many areas in which the data were not adequate to answer the questions we were mandated to investigate.

### WHAT CANADIANS NEED TO KNOW

Data collection should meet the needs of users and other interested parties, such as ministers, government officials and carriers. To determine what information is necessary, we asked whether more or improved data are necessary to:

- predict what will happen to the system if a decision is taken to change it, or if the status quo continues;
- estimate the benefits and costs of proposed changes to the system; and
- evaluate the effects of a policy or program after it has been put in place. (In this case, the information should include the measurement of outputs as well as inputs. At present, governments rarely report on whether or not the programs' objectives have been achieved.)

## CURRENT DATA GAPS

We identified several areas in which there are little or no data on the passenger transportation system. Table 16-1 shows where data gaps exist and how missing data would be used. The table indicates:

- what type of data is needed;
- the type of decision for which the data would be used;
- the contribution of such data in assisting people to participate in decision making;
- the difficulty of obtaining the data (the cost and the burden placed on those who must collect and report the information); and
- whether the gap is primarily one of data collection, estimation or analysis.

*Table 16-1*
*CURRENT DATA GAPS*

| Type of data gap | How data would assist in making policy decisions | Contribution of data to accountability | Costs or burden | Action needed |
|---|---|---|---|---|
| **Comprehensive coverage of services offered (frequency and points served) and prices.** | To study the impacts of regulatory changes.<br>To assess the adequacy of competition. | Good price and service data are key indicators of consumer impact. | Raw data are publicly available from the carriers, but data-base management would be required. | Data assembly and collation. |
| **Information on public infrastructure and capital stock.** | To provide a cost base for infrastructure pricing.<br>To indicate the adequacy of replacement investment. | It will ease the evaluation of previous decisions, improve the transparency of capital costs and allow public capital costs to be compared with those of the private sector. | Establishing appropriate depreciation costs could be complex in some situations. | Estimation of depreciation, collection of data for existing projects. |

*Table 16-1* *(cont'd)*

**CURRENT DATA GAPS**

| Type of data gap | How data would assist in making policy decisions | Contribution of data to accountability | Costs or burden | Action needed |
|---|---|---|---|---|
| **Information on environmental impacts and costs.** | To provide a basis for environmental charges and/or regulatory constraints.<br>To help choose which mode to invest in when alternatives exist. | These data would help transportation policies to achieve environmental goals. | The costs would vary depending on the nature of the data required.<br>The additional burden may be minimal if the data are also being used for an environmental assessment. | Evaluation of environmental damage and collection of data on environmental impacts. |
| **Data on system use and volumes (especially for road travel).** | To determine the demand for expansion when judging new projects.<br>To allocate costs and design pricing policies appropriately.<br>To assist in intermodal planning. | It will be used in evaluating projects and estimating the benefits of new or similar projects. | This may not be costly, either financially or in terms of response burden, if existing or modified highway counting systems can be used. | Data collection. |
| **Information on the origin and destination of trips. (There is a large gap in highway data and some improvement needed in other modes.)** | To provide background to assist in infrastructure investment and intermodal integration.<br>To perform demand modelling. | This information would be helpful for understanding intermodal flows. | The collection of these data would be costly, and would require individual surveys. | Data collection. |

## RECOMMENDATIONS FOR DATA GATHERING

It is important that the data systems that we have begun to develop (in particular the estimates of costs of the passenger transportation system including environmental damage, safety and accident costs) be added to for future use and that data gaps be filled.

Therefore, we **recommend** that:

**16.2 Governments allocate resources to the continuing improvement of travel and other transportation data and the data be available to the public.**

**16.3 Provincial and territorial governments cooperate with the federal government to ensure the collection of data for modes within their jurisdictions.**

## TRANSPARENCY

Better data would improve accountability, but would not necessarily ensure that passenger transportation decisions were more visible to Canadians.

We believe that Canadians should have access not only to information but to the reasons behind decisions that affect them as taxpayers and travellers.

Therefore, we **recommend** that:

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**16.4 The federal government publish an annual report card on the passenger transportation system to include such information as:**

**(a) who uses the transportation system and how much;**

**(b) the amounts and proportions paid by travellers, carriers and taxpayers;**

**(c) why, to whom and by whom subsidies if any are given;**

**(d) the reliability of the passenger transportation system;**

**(e) the safety of the passenger transportation system;**

**(f) the costs not recovered from travellers and carriers for such activities as policing highways, providing medical assistance for victims of traffic accidents, and repairing environmental damage caused by the transportation system; and**

**(g) the degree to which passenger transportation policy, and regulatory and expenditure decisions meet stated objectives.**

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# ENDNOTES

1. *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, April 1991), pp. 156-57.

2. Such subsidies and costs certainly include expenditures for policing highways, providing medical assistance for victims of traffic accidents, and repairing environmental damage caused by the transportation system. They would also, in principle, include any tax expenditures specific to transportation such as capital subsidies for the purchase of transportation equipment.

3. Two examples of improved transparency are the New Zealand Land Transport Fund and the Swiss Road Account. See New Zealand Ministry of Transport's "Land Transport System" and Francis-Luc Perret and P.A. Jaccard, "The Swiss Road Account," in the European Conference of Ministers of Transport, *Report of the Eightieth Round Table on Transport Economics on Systems of Road Infrastructure Cost Coverage,* Paris, February 1989.

# CHAPTER 17

# IMPLICATIONS FOR INTERNATIONAL COMPETITION AND FOREIGN OWNERSHIP

## INTRODUCTION

Policy changes in transportation, as in other sectors of the economy, may affect Canada's economic relations with the rest of the world, particularly the United States, Canada's major trading partner. In the first part of this chapter, we discuss the potential effects that new charges for transportation infrastructure, environmental costs and accident costs will have on Canadian carriers who face international competition.

This chapter also considers, within the context of our principles, the issues associated with foreign ownership and entry of foreign-owned carriers into the Canadian market. We explored aspects of these issues in the discussion of international air policy in Chapter 11. In this chapter, we provide a broader review of how the application of our principles to all modes might affect international competition and investment, including foreign ownership.

## TRANSPORTATION CHARGES AND INTERNATIONAL COMPETITION

Since many Canadian carriers are in competition with foreign carriers, we asked:

- If travellers must pay increased transportation charges, would such increases put Canadian carriers at a disadvantage with foreign competitors?
- Should concern about potential competitive disadvantages constrain the extent to which governments shift transportation costs from taxpayers to travellers?

- In previous chapters, we urge governments to consider the extent to which they treat the modes differently with respect to direct and indirect subsidies and taxes, because these differences may affect the ability of one mode to compete with another. Should governments be equally concerned that the treatment of a particular mode in Canada is different from the treatment of the same mode in other countries, particularly in the United States, where transportation subsidies are extensive?

In examining these questions, we asked more specifically:

- In what circumstances would higher charges create a competitive disadvantage for Canadian carriers?
- Where there is such disadvantage, in what circumstances would it affect the efficient functioning of the Canadian economy?

## SITUATIONS WITH NO COMPETITIVE DISADVANTAGES

We believe there are many situations in which higher charges in Canada will not affect the ability of Canadian carriers to compete with foreign carriers. This is either because such competition does not exist, or because foreign carriers also would be subject to Canadian charges when they provide services that compete with Canadian carriers. Two examples follow.

*Domestic services:* Higher charges do not affect competition on those domestic services where travellers have little choice of alternative routes through the United States — for example, a trip from Calgary to Edmonton. International competition would also likely be unimportant on trips from Toronto to Montreal, and probably the majority of domestic routes. In some cases, however, the higher costs of a domestic trip might influence a traveller, particularly a tourist, to shift to a foreign destination. The result would be some adverse effects for Canadian suppliers of tourist services, and possibly for Canadian carriers.

*Trans-border services:* Higher fuel charges would probably have little effect on the competitive positions of Canadian and foreign carriers. Both groups of carriers face similar needs and opportunities to obtain fuel during the Canadian and foreign portions of their routes. Similarly, higher road tolls, airport landing charges and air navigation fees, which are also directly related to distance travelled or infrastructure used within Canada, would have little effect on the competitive position of Canadian carriers. Higher annual licence fees, however, could put Canadian carriers at a disadvantage unless foreign carriers face a comparable charge in relation to their use of Canadian infrastructure.

It is important to structure Canadian transportation charges so that they apply equally to Canadian and foreign carriers on routes that are entirely or partially in Canada. If equal charges are not possible (for example, if foreign carriers have better access to cheaper fuel than domestic carriers do), then special measures may be necessary. Foreign carriers may have to pay the equivalent of the Canadian charge, or governments may have to make less use of the specific charge.

## SITUATIONS WHERE COMPETITIVENESS IS AFFECTED

In some cases, a route through another country — primarily the United States — can serve as an alternative to a Canadian route. The result is that a foreign or Canadian carrier can avoid the higher Canadian charges associated with the Canadian route. For example, a Vancouver to Toronto air traveller might take two flights involving a U.S. stopover, or might take ground transportation to nearby U.S. airports and fly from the United States. Rerouting via the United States, as a result of higher Canadian charges, could affect Canadian air travel and have a substantial impact on Canadian carriers.

We do not believe there is any gain in keeping traffic in Canada that does not cover costs. For example, raising charges on trucks to cover the costs of wear on Canadian highways might cause some truckers to use U.S. routes with lower charges that do not cover the cost of road wear. If Canadian governments set charges to truckers low enough to retain the traffic in Canada, the gains to the economy from the charges, even with higher traffic, would not cover the costs of road wear; general taxpayers would therefore have to make up the difference. While the competitive position of Canadian truckers may suffer as a result of such higher road charges, maintaining a competitive position through a form of subsidy — charging less than costs — will not benefit the Canadian economy.

Similarly, if a carrier ceases to be competitive when it faces the full costs of its accidents and environmental damage, the Canadian economy is not likely to benefit from maintaining activities that cannot cover these costs.

There are two situations, however, where traffic diverted as a result of Canadian charges could involve a net loss to the Canadian economy: when environmental charges are based on global damages, and when transportation infrastructure charges are substantially higher than marginal costs.

### When Environmental Charges are Based on Global Damages

If Canadian charges for environmental damage are based, not on damage in Canada, but on global damage, diverted traffic may result in a loss to Canada and little gain to the world. For example, Canada could impose a fuel charge for carbon dioxide ($CO_2$) emissions that is much higher than the charge imposed in the United States. The result could be lower revenues for Canada when traffic shifts to the United States and no environmental benefit to Canada or the world. There would be no reduction in $CO_2$ released, only a shifting of emissions out of Canada to the United States.

Although Canada may wish to show leadership in responding to global environmental problems, it will pay an economic price if it moves much ahead of other countries in pursuing such environmental objectives, either through higher charges or through stricter regulatory standards.

In Chapter 7, we identify global warming as a multinational issue and recommend that Canada strive to obtain international agreement on strategies that coordinate national policies and charges aimed at reducing global warming. It would not be appropriate for Canada to differ greatly from competitors in those environmental policies where the benefits of Canadian action are not concentrated in Canada but are global, and where the real benefit to Canada depends not on Canadian action but on global action. Canadians, however, should not lag behind the rest of the world in meeting their responsibilities in reducing global pollution.

### When Transportation Infrastructure Charges are Substantially Higher than Marginal Costs

In Chapter 5, we examined situations in which transportation infrastructure charges may have to be substantially above marginal costs to achieve full cost recovery. In such cases, the value of the benefits received by a group of users should be a factor in determining the extent to which charges are in excess of marginal costs.

In a hypothetical example, the marginal cost associated with providing air navigation services for a passenger aircraft on a Vancouver to Toronto flight could be $100, but a charge of $300 has been set as part of recovering the costs of the air navigation system, since many of its costs do not vary proportionately with use. If such a charge results in an aircraft shifting from a Canadian to a U.S. route, Canada loses $300 in revenue but avoids only $100 in costs. Clearly, if it results in a substantial shift of traffic to the United States, this charging scheme will not be successful in recovering full costs.

In Chapter 5, we described our approach to pricing, in which some infrastructure charges take account of the value of benefits received. In applying that approach to our hypothetical example, one should recognize that:

- The alternative U.S. route reduces the value of the benefit of the Canadian air navigation system to the aircraft operator, who can make use of the U.S. route.

- Because the operator would not value the Canadian infrastructure as highly, the operator's desire to use the Canadian infrastructure would be more responsive to price than that of an operator who had no alternative.
- Therefore, operators in a position to substitute use of foreign infrastructure for a Canadian one should not be charged as high a mark-up over marginal cost as those who have no choice.

We recognize that foreign charges on competing routes and infrastructure do constrain the extent to which transportation charges in Canada should exceed marginal costs. We note, however, that the United States and other countries are changing the way they are charging for their transportation systems.

## CONCLUSION

From our review of transportation charges and international competition, we conclude that:

- The appropriate starting point in setting charges for infrastructure, environmental damage and accidents is still the efficient costs associated with use in Canada for the different modes, rather than the level of foreign charges for the modes.
- Under our principles, net increases in charges to air and car travellers for transportation infrastructure, accidents and environmental damage would generally not be large relative to the overall cost of travel currently borne by travellers (Chapter 18). In addition, such increases would, in part, be offset by the gains that travellers experienced as a result of the new institutional arrangements that were more responsive to their needs, and provided better service.
- In many cases, the absence of foreign competition or the equal treatment of foreign and Canadian competitors, means that the competitive impact of Canadian charges compared with foreign charges would not be significant. Governments should be careful to design charges so that they apply equally to Canadian and foreign carriers using the same routes.

- There are situations, especially where there is a choice between a Canadian route and a foreign route, when the charges may affect the competitive position of Canadian carriers or may affect the route chosen by both Canadian and foreign carriers.
- Even if Canadian charges affect the competitive position of Canadian carriers, Canada's economy will not likely benefit when charges are set below marginal costs.
- There are two situations in which charges are set above marginal costs and in which the level of foreign charges should constrain Canadian charges.

  The first occurs when an environmental charge is based on global damage rather than on damage in Canada. It would be costly for Canada to impose higher charges than those imposed by its major trading partners. We strongly support international coordination of environmental policies and charges.

  The second occurs when transportation infrastructure charges are set above marginal costs to recover infrastructure costs fully. The ability of a group of travellers to substitute use of foreign infrastructure for Canadian infrastructure will constrain the extent to which charges can be raised above marginal costs.

## FOREIGN OWNERSHIP

Under our proposals, any competitor who is "fit, willing and able" to supply passenger carrier services should have an opportunity to do so. We do not distinguish whether the competitor is a domestic or a foreign carrier. In transportation, as in other sectors of the economy, foreign competition can contribute to lower costs and improved product quality. Foreign carrier entry can be particularly important in those markets where actual and potential domestic competition is weak or absent.

Foreign carrier entry into the Canadian market may involve establishing a new Canadian base of operations by the foreign carrier, or acquiring a Canadian carrier. Restrictions on either form of entry may reduce competition and pressures for efficient performance. Restrictions on foreign ownership could also result in a carrier being taken over by an existing domestic carrier, leading to a substantial increase in market concentration. In addition, controls on foreign ownership may prevent a firm from being integrated into a larger multinational operation and realizing major gains in efficiency.

At the same time, trade barriers — which Canada is not in a position to eliminate through its actions alone — prevail in world markets for some transportation services. These barriers should be taken into account when judging Canadian trade and foreign ownership policies.

## AIR CARRIERS

As discussed in Chapter 11, today Canadian air carriers can enter foreign markets only through government-to-government negotiations in which foreign carriers are simultaneously offered increased access to Canadian markets. Unilaterally opening Canadian markets by giving landing rights to foreign carriers, in effect "giving away our bargaining chips," would foreclose opportunities for Canadian carriers to gain entry into new foreign markets. As we noted in Chapter 11, giving landing rights could also lead to the creation of monopolies on certain important international routes. A foreign government may be inclined to take advantage of the resulting opportunity to designate its national airline as the sole carrier on major routes to and from Canada.

We conclude that, in general, the federal government should not depart unilaterally from the special rules of government-to-government negotiation that characterize international air services. We recognize, however, that this approach may conflict with the need to maintain competition and ensure that air travellers are provided with low-cost, reliable service. Recommendation 11.6 and the final section of Chapter 11 on Open Skies address those situations where the benefits from new entry justify a departure from the traditional approach toward foreign ownership and competition in the airline industry.

## RAIL CARRIERS

Passenger rail carriers generally operate within the borders of their home countries. This is true for VIA Rail in Canada and Amtrak in the United States, with the following exceptions:

- VIA Rail routes between Montreal and Halifax pass through Maine; and
- Amtrak uses Canadian track on its services into Toronto and Montreal and, in collaboration with VIA Rail, provides some domestic service in southern Ontario.

We do not believe that there is reason to restrict access to Canadian track by a foreign-owned rail carrier as long as the foreign carrier pays appropriate charges and is governed, while operating in Canada, by the same rules that govern Canadian-owned carriers.

## BUS CARRIERS

Most companies in Canada's regulated intercity bus industry are domestically controlled. An exception is the country's largest carrier, Greyhound Lines of Canada Ltd., which is controlled by U.S. shareholders. Greyhound Canada's intercity bus operations earned about 40 percent of total industry revenue in 1989, or about three times as much as the next-largest intercity bus carrier. Our recommendations in Chapter 13 would benefit Canadian travellers by easing entry into the industry for both Canadian-controlled and foreign-controlled firms. The result would be a competitive environment that encouraged bus companies to innovate, reduce costs and improve service.

Bus carriers from the United States seeking entry into Canada would be subject to similar "fit, willing and able" criteria as Canadian carriers seeking to compete in those U.S. jurisdictions that have eliminated economic regulation. Many states in the United States continue to restrict entry into their intrastate markets. The United States *Bus Regulatory Reform Act, 1982*, however, deregulated interstate busing and allowed the Interstate Commerce Commission to grant interstate carriers the right to serve points within a state on a new or existing interstate route.

We encourage the federal government to press for a relaxation of entry restrictions into those U.S. states that continue to impose economic regulation. Whatever emerges from such negotiations, however, we believe the interests of Canadian travellers are best served by relaxing provincial entry controls that apply to all firms, foreign as well as Canadian-owned.

## FERRY CARRIERS

There are no Canadian restrictions on the ownership or control of ferry services. Restrictions do exist on the vessels that may be used to carry passengers between two Canadian ports, but such restrictions are designed to protect the Canadian shipbuilding industry, not the ferry operators. (Domestic water transportation is reserved for Canadian-registered ships. Foreign-registered vessels are subject to a substantial customs import duty, unless a waiver can be obtained owing to the lack of a suitable Canadian-registered vessel.) By contrast, the United States is highly protective of its carriers. Under the *Jones Act*, only U.S.-owned ferries can transport passengers between two ports in the United States. We believe this is an inappropriate model for Canada. Foreign ownership and entry restrictions are not consistent with our principles and are not in the long-term interest of Canadian ferry users.

In all modes, Canada will benefit from foreign competition as long as foreign carriers operating in Canada are governed by the same regulations that govern Canadian carriers.

# CHAPTER 18

# ADDING IT ALL UP: PASSENGER TRANSPORTATION COSTS — TODAY AND TOMORROW

## INTRODUCTION

In this chapter, we provide estimates of the costs of transportation today and how we expect our principles to affect these costs in the future. To demonstrate how our recommendations would change costs, Tables 18-1 to 18-4 show:

- what is paid today, and by whom;
- what would be paid in the year 2000, and by whom, if governments do not change current transportation policy; and
- what would be paid in the year 2000, and by whom, if governments implement the recommendations in this report.

We want to stress that our recommended changes in charges to travellers are not an "add on" to existing fees, charges and taxes paid by Canadians. Canadians are already paying all the costs of transportation in some way. Increases in charges to travellers will be offset by making available billions of dollars annually that governments can use to lower taxes. As well, our charges to travellers are based on the provision of an efficient level of services and infrastructure, not "gold-plated" ones — you get what you pay for and only pay for what you get.

All estimated costs, for today and for the future, are in 1991 dollars. We did not build in estimates of inflation in the general level of prices that may occur between 1991 and 2000. We believe that giving costs in same-year dollars provides a better comparison.

We ask readers to understand that the costs in the tables and the text are not precise estimates, but are rough indications of the direction and magnitude of change and of the differences among the costs by mode. Providing precise estimates of future passenger transportation costs is beyond the scope and resources of the Royal Commission. When governments implement our recommendations, producing more precise estimates will require a substantial amount of work.

We cannot forecast with any precision how the Canadian population, economy and society will develop over the coming decades, or how the location of activities and the demands for intercity travel might alter. We do expect that intercity travel will continue to grow faster than the population and general economic activity, probably doubling each generation, and that long-distance travel, particularly by airplane, will grow faster still. Governments will implement our recommendations against this background of continual change. Our recommendations, in turn, will bring about further changes.

We do not believe that it is necessary to have precise forecasts to be confident that the effects of our recommendations will be beneficial. Under our principles, carriers and travellers will pay the full costs of travel. The result will be that they use transportation resources more efficiently in their choice of trips, modes and routes. For example:

- Transfer of road costs from taxpayers to car and other motor vehicle users will affect car use, causing consolidation of trips and — everything else being equal — shifts to other means of travel. There will be some encouragement of denser patterns of land use and of slower growth in car ownership.
- Reduction of fares on buses, following relaxation of economic regulation, will stimulate bus use, with some travellers switching from other means of travel and others making bus trips they would otherwise not have made.

- Charges for environmental damage will lead consumers to use cars that cause less damage, and may lead car makers to manufacture less-polluting cars.

The resulting changes in total travel and in the share of each mode will depend on many factors that interact in subtle and complex ways. We cannot forecast all the changes that will occur and their impact on transportation costs. But we can predict the major changes that will affect transportation costs for travellers, carriers and providers of infrastructure.

## COSTS FOR ILLUSTRATIVE ROUTES

We present illustrative costs for four intercity routes that represent different types of travel by length, passenger volume and carrier type. The costs are not specific to the routes, but are based on average costs for the type of service and distance.

***Four Illustrative Routes***

- **Saskatoon to Halifax: a long-distance route consisting primarily of medium-volume segments.**
- **Toronto to Montreal: a high-volume, medium-distance route.**
- **Churchill to Winnipeg: a low-volume, medium-distance route with no continuous road.**
- **Halifax to St. John's: a medium-volume, medium-distance route that may include ferry travel.**

## READING THE TABLES

The following categories of transportation costs are shown in each route table:

***Types of Transportation Costs***[a]

| | |
|---|---|
| **Infrastructure:** | **costs of terminals, links and traffic control systems not provided by carriers.** |
| **Environmental:** | **costs of environmental damage associated with vehicle/carrier opertions.** |
| **Accident:** | **costs of death, injury (including health care costs) and property damage associated with transportation accidents.** |
| **Special Tax/Fee:** | **costs of fuel taxes and vehicle, carrier and drivers' licences.** |
| **Vehicle/Carrier:** | **costs of vehicles and carrier services.** |

**a. For more-detailed information on types of transportation costs, see Chapter 3.**

The three blocks in the route tables with three columns in each block illustrate transportation costs in the following manner:

- "1991" shows current costs by means of travel. These figures are calculated on the same basis as the estimates in Chapter 3, and are identical to the Chapter 3 tables where they apply to the same routes.
- "2000 S-Q" shows costs projected for the year 2000, presuming the status quo (that is, no substantial adjustment to current transportation policy).
- "2000 D" projects costs for the year 2000, presuming that the recommendations in this report, *Directions*, are implemented.

Within each block, we identify two groups that pay the costs of transportation: users and others. "Users" include travellers and carriers.

"Others" are taxpayers and those affected by such factors as environmental pollution. The three columns in the block show costs paid by users and others and the total costs.

| ***Users*** | ***Others*** |
|---|---|
| **Travellers** | **Taxpayers, through direct subsidies to carriers and subsidies for infrastructure** |
| **Carriers** | **General public, through the effects of environmental damage** |
| **Vehicle owners** | **Taxpayers, through health care costs of accident victims** |
| | **Travellers on other routes (cross subsidy)** |

**Users' Costs + Others' Costs = Total Costs**

If our recommendations changed how Canadians pay for passenger transportation, but did not change governments' or carriers' behaviour in providing transportation, or travellers' use of transportation, the impact would be simply to shift costs from others to travellers, with no impact on total costs.

In other words, total costs in the 2000 D case would be identical to the 2000 S-Q case, but others' costs in the 2000 D case would have dropped to zero (or close to zero, subject to some remaining transitional subsidies), while users' costs would have increased by a corresponding amount.

In fact, we expect that our recommendations will lead to changes in the behaviour of governments, carriers and travellers; changes that will reduce the total costs of providing transportation services. Therefore, we expect several components of the total costs in the 2000 D case to be lower than in the 2000 S-Q case, and costs to users will not, in general, have to rise by the full amount of the reduction in costs borne by others. Inevitably, our estimates of these reductions are often quite approximate; they are intended to indicate the order of magnitude of the potential for cost reductions that might reasonably be achieved when our recommendations are implemented.

The tables show cost component estimates to the nearest dollar, although in many cases the figures are subject to margins of uncertainty of several dollars or, in some cases, several tens of dollars. We trust readers will bear with us when we refer to, for example, a cost of $378, and will interpret this as roughly $400. Our use of nearest-dollar figures is motivated by our wish to show some cost components that are only a few dollars, coupled with our wish to allow readers to see how the figures in the tables add up — which would be obscured by use of rounded components and totals.

Charts 18-1 to 18-4, corresponding to the tables, provide an alternative display of the 2000 S-Q and 2000 D cases (see explanation of chart format in Chapter 3).

All four routes share common features, and we discuss these in the text for the first route, Saskatoon to Halifax.

## ROUTE #1: SASKATOON TO HALIFAX

### Saskatoon to Halifax: 1991 Costs

The average overall costs per person travelling this type of route are $747 by car, $313 by bus, $443 by airplane and $1,532 by train.

For car travel, travellers pay $168 in accident costs (through insurance premiums and uncompensated damage losses), $53 in special taxes and fees, and $487 for vehicle/carrier expenses. Of others' costs, governments pay $67 to provide infrastructure. The public bears the environmental damage costs, estimated at $19 in winter and $24 in summer, or an average of $21 year-round. Another $4 for health care costs is unrecovered from motor-vehicle insurance companies and is paid by governments, but they receive $53 in special taxes and licence fees from motorists. In aggregate, travellers pay $708, while others pay $39 per car traveller for a route of this type.

Table 18-1

## ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER IN 1991, 2000 "STATUS QUO" AND 2000 "DIRECTIONS" — ROUTE #1, SASKATOON TO HALIFAX

Dollars per trip, in 1991 dollars

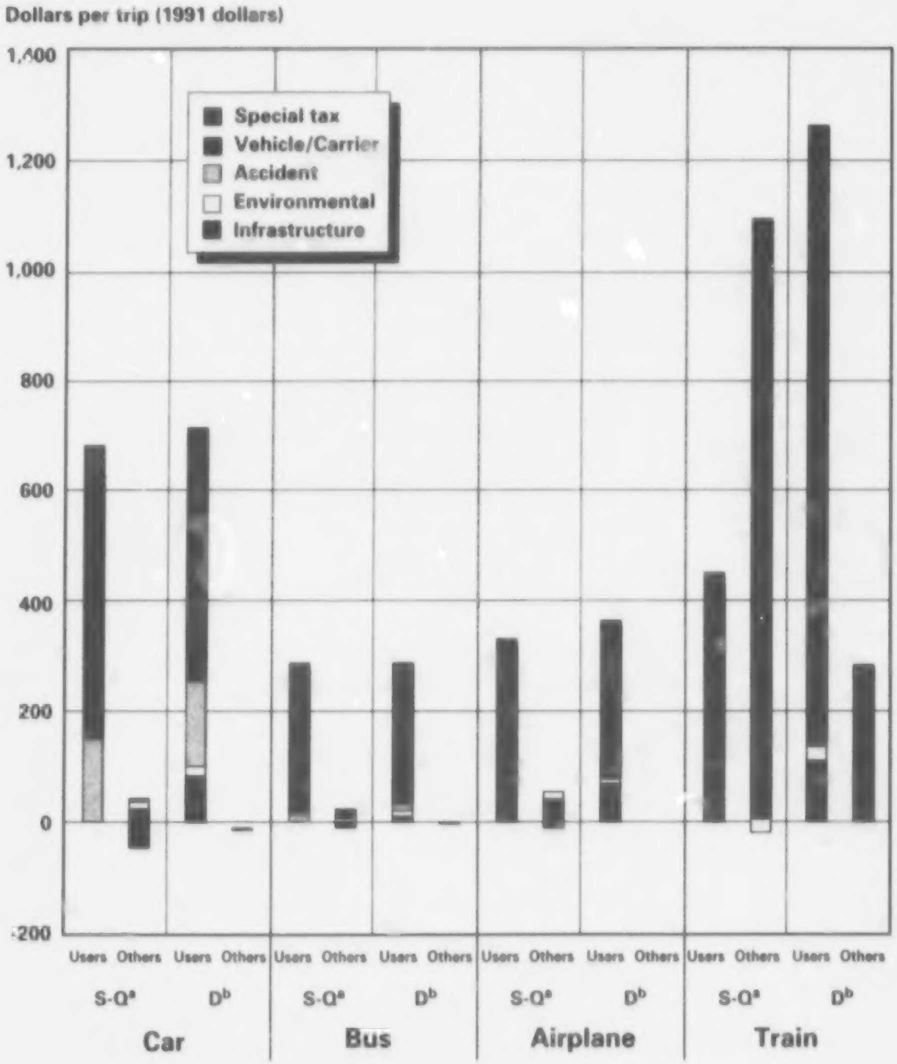
| | Car 1991 | | | Car 2000 S-Q | | | Car 2000 D | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 0 | 67 | 67 | 0 | 67 | 67 | 81 | -18 | 63 |
| **Environmental** | 0 | 21 | 21 | 0 | 18 | 18 | 16 | 0 | 16 |
| **Accident** | 168 | 4 | 172 | 151 | 3 | 154 | 154 | 0 | 154 |
| **Special tax/fee** | 53 | -53 | 0 | 53 | -53 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 487 | 0 | 487 | 476 | 0 | 476 | 468 | 0 | 468 |
| **Total** | **708** | **39** | **747** | **680** | **35** | **715** | **719** | **-18** | **701** |
| | **Bus 1991** | | | **Bus 2000 S-Q** | | | **Bus 2000 D** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 0 | 8 | 8 | 0 | 8 | 8 | 9 | -1 | 8 |
| **Environmental** | 0 | 7 | 7 | 0 | 7 | 7 | 5 | 0 | 5 |
| **Accident** | 18 | 0 | 18 | 16 | 0 | 16 | 16 | 0 | 16 |
| **Special tax/fee** | 9 | -9 | 0 | 9 | -9 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 261 | 19 | 280 | 261 | 19 | 280 | 252 | 0 | 252 |
| **Total** | **288** | **25** | **313** | **286** | **25** | **311** | **282** | **-1** | **281** |
| | **Airplane 1991** | | | **Airplane 2000 S-Q** | | | **Airplane 2000 D** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 37 | 68 | 105 | 37 | 47 | 84 | 66 | 0 | 66 |
| **Environmental** | 0 | 22 | 22 | 0 | 18 | 18 | 17 | 0 | 17 |
| **Accident** | 4 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 4 |
| **Special tax/fee** | 15 | -15 | 0 | 13 | -13 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 368 | -56 | 312 | 272 | 0 | 272 | 272 | 0 | 272 |
| **Total** | **424** | **19** | **443** | **326** | **52** | **378** | **359** | **0** | **359** |
| | **Train 1991** | | | **Train 2000 S-Q** | | | **Train 2000 D[a]** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 93 | 0 | 93 | 99 | 0 | 99 | 113 | 0 | 113 |
| **Environmental** | 0 | 28 | 28 | 0 | 28 | 28 | 23 | 0 | 23 |
| **Accident** | 8 | 0 | 8 | 8 | 0 | 8 | 8 | 0 | 8 |
| **Special tax/fee** | 21 | -21 | 0 | 21 | -21 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 264 | 1,139 | 1,403 | 322 | 1,090 | 1,412 | 1,127 | 285 | 1,41 |
| **Total** | **386** | **1,146** | **1,532** | **450** | **1,097** | **1,547** | **1,271** | **285** | **1,556** |

**a. It is assumed that passengers would abandon some of this rail service before 2000, as subsidies were gradually withdrawn.**

**Note: In order to illustrate smaller components, route totals are shown to the nearest dollar. In general, cost estimates are not accurate to this level of precision. See text for qualifications.**

*Chart 18-1*

ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER PROJECTED TO 2000, SASKATOON TO HALIFAX



a. S-Q is status quo for year 2000.
b. D is with the recommendations in "Directions" implemented in 2000.

Note: The chart is a graphic representation of Table 18-1. Any negative components of costs borne by others are represented by shifting the others bar below the zero line.[1]

By comparison, the average traveller using a public carrier pays $288 for bus, $424 for airplane and $386 for train. Others pay $25 of the costs per trip by bus, $19 per trip by airplane, and $1,146 per trip by train.

For airplanes, the vehicle/carrier cost borne by others (–$56) shows that the charges to air travellers are $56 more than the costs of providing the service. The system-average revenue for journeys of this length in southern Canada is $368 (net of taxes, infrastructure charges and traveller-borne accident costs) and the system-average cost (including normal profits) is $312. Air travellers on this route pay $56 toward the cost of other air routes. This type of route is thus currently estimated to be characterized by above-average profitability. Differences in the profitability of route types change over time. We have assumed that the average fare equals the average cost for the year 2000 in both the 2000 S-Q and the 2000 D scenarios.

### Saskatoon to Halifax: 2000 Status Quo

The estimated costs of travel in the future, without any significant change in transportation policy, allow for the following anticipated developments in traffic and technology:

- Domestic air travel and road traffic grow at 3 percent per year. We have adjusted the costs for infrastructure provided by governments to accommodate this growth.
- Considerable reductions in fuel consumption per passenger-kilometre occur as a result of new technology and the turnover of vehicle fleets — 13 percent on average for cars, and 15 percent for aircraft. Such reductions will lessen carbon dioxide ($CO_2$) emissions from these vehicles by the same proportions. Improved motor-vehicle emission control equipment reduces average emissions of nitrogen oxides ($NO_x$) and volatile organic compounds (VOCs) by 40 percent.
- New train technologies may contribute to reducing costs such as environmental damage, but we have not shown any improvement by the year 2000 given the slow turnover of long-lasting railway

locomotives. We also assume that rail passenger cars and service levels will be upgraded on the Western Transcontinental. This will be accompanied by some increase in infrastructure costs, vehicle/carrier costs, and revenues from users.

- Newer aircraft make substantially less noise; thus average noise costs fall as older models are replaced.
- Improvements in road safety continue, reducing accident costs per passenger-kilometre for car and bus by 10 percent.

Overall, total costs in 2000 S-Q fall from 1991 levels by approximately 4 percent per car trip and 15 percent per airplane trip.

### Saskatoon to Halifax: 2000 Directions

We expect important changes in all modes as a result of the implementation of our recommendations.

*Car:* The special transportation tax/fees (fuel tax and licence fees) will be replaced by specific charges for infrastructure and environmental damages. If special taxes are viewed as charges for road infrastructure, in 2000 S-Q the overall recovery of infrastructure costs from travellers is only 50 percent across the entire road network, although it amounted to $53 out of $67 on this type of route.

We expect that in the year 2000, road charges will still need to be averaged across all highways within a province or territory, although charging by route will eventually be feasible. We show the cost to users for infrastructure provided on this route as an $81 road charge in 2000 D, generating a $18 surplus over the road costs for this type of route. This is necessary to cover the deficits on more-lightly travelled highways. We expect total road costs to fall as a result of improvements in investment planning and consultation with users in the rate-setting process. This is represented by a 5 percent decrease in road infrastructure costs for car travel over the 2000 S-Q costs.

The environmental damage charge would be set at the rate for air pollutant damage, most probably as a fuel surcharge. We expect that this charge, together with the increase in fuel charges described in the preceding paragraph, will stimulate travellers to reduce fuel consumption and emissions. The result is represented by a 10 percent reduction in fuel use, and thus in environmental damage and in the fuel component of vehicle/carrier costs. The environmental damage charge to travellers is $15 per trip in winter and $18 in summer, or $16 averaged over the year.

Users pay $39 more than the 2000 S-Q costs, or a 6 percent increase. Others do not pay anything, and the $18 surplus pays for less-used highways in the provinces through which the route passes. In total, the combined costs of car travel will fall by about 2 percent from 2000 S-Q to $701 for this type of trip.

*Bus:* Bus companies, and hence bus travellers, currently and in 2000 S-Q, pay special transportation taxes/fees that, on average, more than meet the costs of the roads; thus the infrastructure charge would not differ appreciably from the current fuel tax ($9). The environmental charge to users would be $5 per trip, resulting in a slight increase per passenger in the total of infrastructure charges, environmental charges, accident costs and special taxes (with the latter having disappeared in the 2000 D scenario).

With our recommendations in place, however, the bus industry would be open to competition, giving bus companies greater commercial freedom and eliminating cross subsidization of low-volume services from higher-volume routes. The resulting improved efficiency is represented by reductions of 10 percent per passenger in vehicle/carrier costs (from $280 in the 2000 S-Q case to $252 in the 2000 D case).

The 2000 D case shows a decline of $4, or 1 percent, in total users costs; the savings induced by greater competition would, in this case, be substantially offset by the elimination of cross subsidy.

*Airplane:* Under our recommendations, the federal government will transfer the costs of airports and the air navigation system from taxpayers to travellers. In addition, most airports and the air navigation system would be run as commercial operations. For a Saskatoon–Toronto–Halifax routing, we expect such changes would reduce total air infrastructure costs from $84 per trip in 2000 S-Q to $66 per trip in 2000 D. These costs would be paid directly or indirectly by air travellers.

The environmental charge to users would be $17 per user per trip in 2000 D; at the same time, governments will eliminate special fuel taxes. The net increase or charges, in turn, would cause carriers to slightly reduce fuel consumption.

Overall, fares (total costs to users) would rise by 10 percent, or $33, reflecting the transfer of costs from the taxpayer to the traveller, but total air trip costs would fall by 5 percent.

*Train:* We are recommending that taxpayers provide passenger rail with declining subsides during a 10-year transition period. Much of the rail route between Saskatoon and Halifax is lightly used, and there are few prospects for substantial reduction in costs. For the year 2000, we show the subsidy as three-quarters phased out. The price to potential train travellers on this route, assuming no change in the number of passengers, would have risen substantially — to more than three times the average price of air travel. It seems likely that the number of travellers choosing the train would decline on several of the links that make up this route, and that passenger rail service, on some of these links, would be discontinued prior to 2000.

## ROUTE #2: TORONTO TO MONTREAL

### Toronto to Montreal: 1991 Costs

Total costs per passenger-trip on routes of the Toronto to Montreal type are $89 by car, $37 by bus, $194 by airplane and $137 by train.

On this type of route, bus passengers do not impose costs on others. The road-infrastructure costs and environmental costs are approximately balanced by special transportation taxes/fees (primarily fuel taxes). As well, fares paid by bus travellers exceed carrier costs; the excess is available to cross subsidize other bus services.

For the remaining types of travel:

- Others pay $4 of the total cost per car trip, because special taxes do not fully cover infrastructure, environmental and accident costs.
- On airplane flights, taxpayers and the public contribute a $20 shortfall in cost recovery on government-provided infrastructure plus $6 in environmental costs, minus $3 received from special (fuel) taxes. Travellers on other air routes provide $35 in estimated cross subsidy toward vehicle/carrier costs. (Travellers on this route make a lower than average contribution to overhead.)[2] Thus, in total, others contribute $58 per trip by airplane.
- Others pay $84 of the costs per passenger of the train service, nearly all for the direct subsidy to VIA Rail's vehicle/carrier costs.

### Toronto to Montreal: 2000 Status Quo

Costs per bus trip are projected to remain constant, while costs in the other modes would decrease slightly. We expect important improvements in train travel through cost economies, service improvements and revenue enhancement, so that overall cost recovery from train travellers on this route would increase from 39 percent in 1991 to 47 percent by 2000.

*Table 18-2*

## ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER IN 1991, 2000 "STATUS QUO" AND 2000 "DIRECTIONS" — ROUTE #2, TORONTO TO MONTREAL

Dollars per trip, in 1991 dollars

| Type of cost | Car 1991 | | | Car 2000 S-Q | | | Car 2000 D | | |
|---|---|---|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 6 | 6 | 0 | 6 | 6 | 11 | -5 | 6 |
| Environmental | 0 | 4 | 4 | 0 | 3 | 3 | 3 | 0 | 3 |
| Accident | 20 | 0 | 20 | 18 | 0 | 18 | 18 | 0 | 18 |
| Special tax/fee | 6 | -6 | 0 | 6 | -6 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 59 | 0 | 59 | 57 | 0 | 57 | 56 | 0 | 56 |
| **Total** | 85 | 4 | 89 | 81 | 3 | 84 | 88 | -5 | 83 |

| Type of cost | Bus 1991 | | | Bus 2000 S-Q | | | Bus 2000 D | | |
|---|---|---|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Environmental | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| Accident | 2 | 0 | 2 | 2 | 0 | 2 | 2 | 0 | 2 |
| Special tax/fee | 1 | -1 | 0 | 1 | -1 | 0 | 0 | 0 | |
| Vehicle/Carrier | 37 | -3 | 34 | 37 | -3 | 34 | 31 | 0 | 31 |
| **Total** | 40 | -3 | 37 | 40 | -3 | 37 | 34 | 0 | 34 |

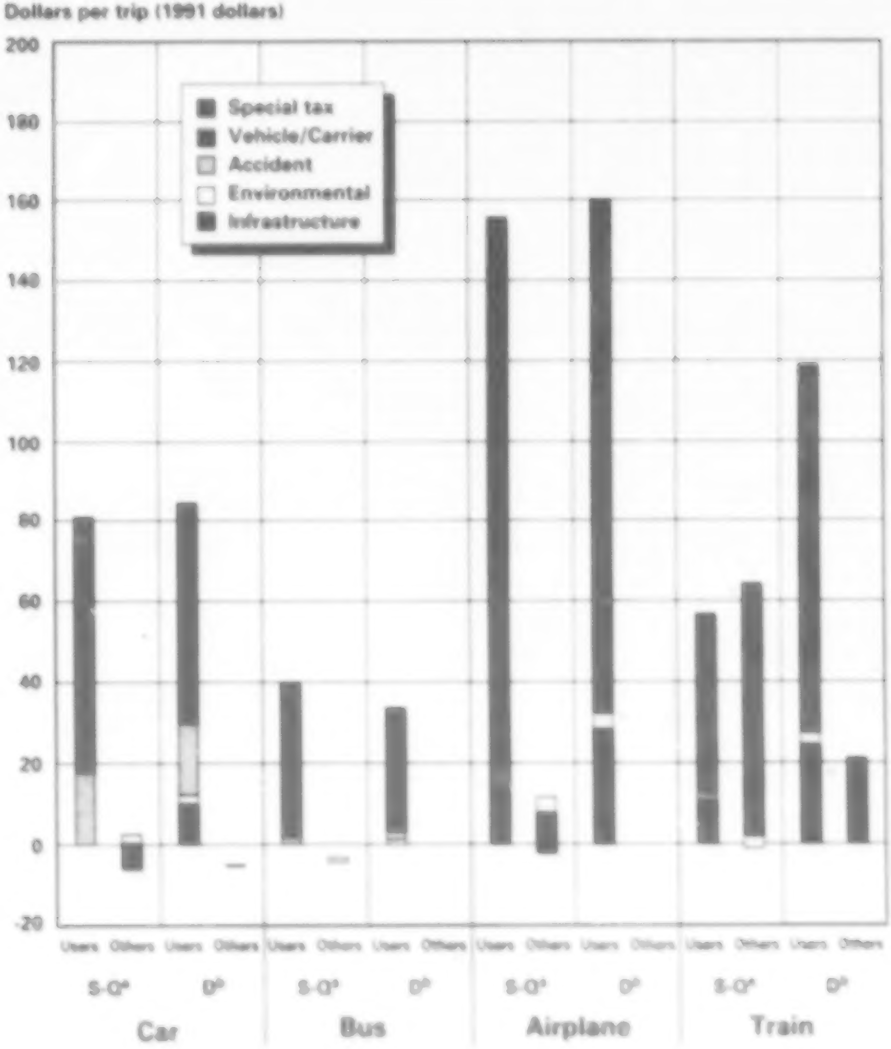
| Type of cost | Airplane 1991 | | | Airplane 2000 S-Q | | | Airplane 2000 D | | |
|---|---|---|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 22 | 20 | 42 | 24 | 10 | 34 | 28 | 0 | 28 |
| Environmental | 0 | 6 | 6 | 0 | 4 | 4 | 4 | 0 | 4 |
| Accident | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Special tax/fee | 3 | -3 | 0 | 3 | -3 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 111 | 35 | 146 | 128 | 0 | 128 | 128 | 0 | 128 |
| **Total** | 136 | 58 | 194 | 155 | 11 | 166 | 160 | 0 | 160 |

| Type of cost | Train 1991 | | | Train 2000 S-Q | | | Train 2000 D | | |
|---|---|---|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 9 | 0 | 9 | 11 | 0 | 11 | 25 | 0 | 25 |
| Environmental | 0 | 3 | 3 | 0 | 3 | 3 | 3 | 0 | 3 |
| Accident | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| Special tax/fee | 1 | -1 | 0 | 1 | -1 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 42 | 82 | 124 | 44 | 62 | 106 | 90 | 21 | 111 |
| **Total** | 53 | 84 | 137 | 57 | 64 | 121 | 119 | 21 | 140 |

Note: In order to illustrate smaller components, route totals are shown to the nearest dollar. In general, cost estimates are not accurate to this level of precision. See text for qualifications.

*Chart 18-2*

ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, PROJECTED TO 2000, TORONTO TO MONTREAL



a. S-Q is status quo for year 2000.
b. D is with the recommendations in "Directions" implemented in 2000.

Note: The chart is a graphic representation of Table 18-2. Any negative components of costs borne by others are represented by shifting the others bar below the zero line.

**Toronto to Montreal: 2000 Directions**

*Car:* With our recommendations in place, overall costs, including environmental damage and accident costs, would fall slightly. Infrastructure charges and environmental damage charges would amount to $14 per traveller, or an increase of $8 on average per traveller over the equivalent charges (the special tax of $6) in 2000 S-Q. If this increase were charged entirely as a fuel tax, it would amount to 25 cents per litre of gasoline at current fuel consumption rates (our estimates of costs per traveller assume an average of 1.8 travellers per car).

*Bus:* As a result of deregulation and the elimination of cross subsidization through fares, total costs to users would fall by 15 percent from 2000 S-Q, becoming $34 per trip.

*Airplane:* More economical operation of airports and the air navigation system between the 2000 S-Q and 2000 D scenarios would reduce infrastructure costs by 18 percent. Eliminating the $10 subsidy from others for airport and air navigation infrastructure in 2000 S-Q would then require only a $4 increase in infrastructure charges, to $28, in 2000 D. The environmental charge of $4 compares with $3 in special taxes to users in the 2000 S-Q scenario.

*Train:* Cost recovery in 2000 S-Q would still be only about half of that required for viability, and in 2000 D, train vehicle/carrier subsidies would have decreased over a transition period. We believe, however, that there is a potential for train travel to succeed with our recommendations in place. Improved speed, comfort and service are possible on this route. Train travel could become attractive even at much higher fares. Total infrastructure and vehicle/carrier costs would increase 15 percent to $136 per trip ($25 + $111), but there would also be an increase in total revenues per user from $57 to $119. The 2000 D fare would still be $41 less than the air fare ($160 – $119). The taxpayer vehicle/carrier subsidy, which would not be completely phased out by 2000, would cover the difference of about $21 per trip.

## ROUTE #3: CHURCHILL TO WINNIPEG

### Churchill to Winnipeg: 1991 Costs

This remote route is of interest because it includes a substantial community that cannot be reached by car. Travellers from Churchill must use an airplane or train to reach Winnipeg. The costs of these modes today are:

*Airplane:* Users pay a total of $262 in air fare, while others pay $280 for the costs of the air infrastructure, particularly the Churchill airport. The total cost by air is $530 per trip.

*Train:* Users pay $229 in fares. The taxpayer contributes $2,749 per passenger to the trip — more than ten times as much as is paid by the traveller — and the total cost is almost $3,000 per passenger.

### Churchill to Winnipeg: 2000 Status Quo

Projected growth in air traffic for 2000 S-Q would reduce the cost of the airport and the air navigation system, when averaged over more passengers, but the total infrastructure cost would still be $217 per passenger. We do not foresee any decrease in costs or increase in revenues for rail service.

### Churchill to Winnipeg: 2000 Directions

For the 2000 D model, our assumptions for this type of route are as follows:

*Airplane:* Based on costs at similar non-Transport Canada airports, we believe that scaling the Churchill airport down to a size adequate to handle forecast demand, anu allowing management to pursue efficiency, would reduce the total air infrastructure costs. The historical capital costs associated with the larger airport would not determine pricing during the transition. Rather, pricing would cover new capital spending to maintain the smaller airport. The reduced infrastructure costs would still be high compared with system-average airport costs,

*Table 18-3*

## Illustrative Comprehensive Costs per Passenger in 1991, 2000 "Status Quo" and 2000 "Directions" — Route #3, Churchill to Winnipeg

| Dollars per trip, in 1991 dollars | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type of cost** | **Airplane 1991** | | | **Airplane 2000 S-Q** | | | **Airplane 2000 D** | | |
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 28 | 280 | 308 | 25 | 192 | 217 | 34 | 9 | 43 |
| Environmental | 0 | 7 | 7 | 0 | 6 | 6 | 6 | 0 | 6 |
| Accident | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| Special tax/fee | 8 | –8 | 0 | 7 | –7 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 225 | –11 | 214 | 190 | 0 | 190 | 190 | 0 | 190 |
| **Total** | **262** | **268** | **530** | **223** | **191** | **414** | **231** | **9** | **240** |
| **Type of cost** | **Train 1991** | | | **Train 2000 S-Q** | | | **Train 2000 D[a]** | | |
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 186 | 94 | 280 | 186 | 94 | 280 | | | |
| Environmental | 0 | 23 | 23 | 0 | 23 | 23 | | | |
| Accident | 2 | 0 | 2 | 2 | 0 | 2 | | | |
| Special tax/fee | 41 | –41 | 0 | 41 | –41 | 0 | | | |
| Vehicle/Carrier | 0 | 2,673 | 2,673 | 0 | 2,673 | 2,673 | | | |
| **Total** | **229** | **2,749** | **2,978** | **229** | **2,749** | **2,978** | | | |
| **Type of cost** | **Bus–Train 1991** | | | **Bus–Train 2000 S-Q** | | | **Bus–Train 2000 D[b]** | | |
| | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | | | | | | | 10 | 0 | 10 |
| Environmental | | | | | | | 4 | 0 | 4 |
| Accident | | | | | | | 4 | 0 | 4 |
| Special tax/fee | | | | | | | 0 | 0 | 0 |
| Vehicle/Carrier | | | | | | | 121 | 40 | 161 |
| **Total** | | | | | | | **139** | **40** | **179** |

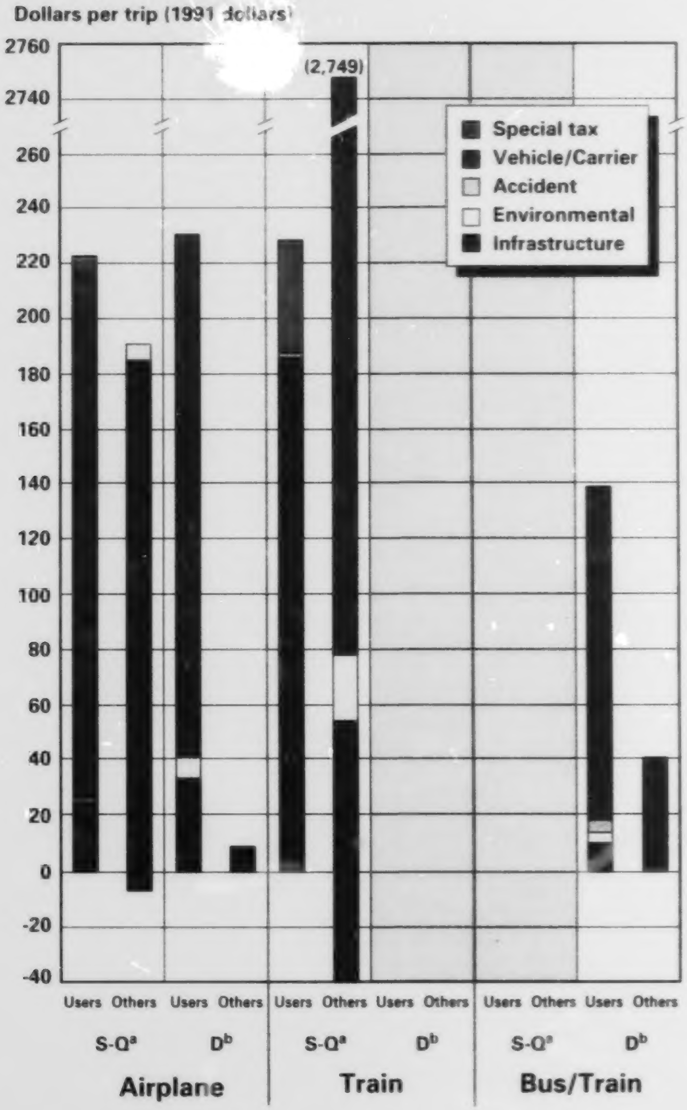
a. It is reasonable to predict that this rail service would be discontinued before 2000.

b. The bus–train service is shown as an alternative to air travel, presuming the through train service was discontinued.

Note: In order to illustrate smaller components, route totals are shown to the nearest dollar. In general, cost estimates are not accurate to this level of precision. See text for qualifications.

Chart 18-3

ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, PROJECTED TO 2000, CHURCHILL TO WINNIPEG



a. S-Q is status quo for year 2000.

b. D is with the recommendations in "Directions" implemented in 2000.

Note: The chart is a graphic representation of Table 18-3. Any negative components of costs borne by others are represented by shifting the others bar below the zero line.[1]

but a major improvement over those shown in 2000 S-Q. Charging this amount to air travellers would constitute a steep increase in infrastructure charges to users (Recommendation 5.2) and result in a (decreasing) transitional subsidy from others, illustrated by the $9 shown in the table. Total infrastructure costs would be $43. The total fare paid by air travellers would rise from $223 in 2000 S-Q to $231.

*Train:* Since train service will never approach self-sufficiency on this route, we predict that the current service would be discontinued before 2000; we therefore show no figures for standard rail service in 2000 D. We searched for an alternative that passengers could afford and that did not impose such large costs on the taxpayer. Passengers from smaller communities along the rail line from Gillam to Churchill can be reliably served only by the train; the airplane-only option is restricted to residents of Churchill itself. We therefore developed a model for a bus-train intermodal system that would be effective and reasonably priced.

*Bus-Train:* There is bus service from Winnipeg to Gillam, 265 kilometres south of Churchill. This bus service combined with a mixed train (offering coach and freight services) would provide transportation to Churchill. Although the train segment of this bus-train service would lack the comforts of the present sleeper service (meal and beverage amenities), the distance and time involved would be much less. Such a service could achieve, or come much closer to achieving, full cost recovery. It is another example of when a transitional subsidy would be warranted. This is represented by a $40 others' contribution to vehicle/carrier costs. The subsidy would be payable on the Gillam to Churchill segment of the route. The total cost would be $179 per passenger.

*Other alternatives:* The very small population that lives along the rail line from Gillam to Churchill could also be served from Winnipeg by air to Gillam or Churchill and by the revised train service discussed earlier.

## ROUTE #4: HALIFAX TO ST. JOHN'S

This route involves crossing between Nova Scotia and Newfoundland by air or by one of the two ferries: the year-round service between North Sydney, Nova Scotia, and Port aux Basques, Newfoundland, or the summer service between North Sydney, Nova Scotia, and Argentia, Newfoundland.

The combined road and ferry distances differ greatly between these two routes.

- Using the Port aux Basques ferry, the crossing is 178 kilometres and the road trip is 1,267 kilometres, for a total trip of 1,445 kilometres.
- Using the Argentia ferry, the crossing, which is 519 kilometres, reduces the road trip by 798 kilometres to 469 kilometres, for a total trip length of 988 kilometres.

With the exception of Halifax to Truro, no passenger rail services exist between Halifax and St. John's. The alternative means from Halifax to St. John's are airplane, bus-ferry or car-ferry. Table 18-4 illustrates five route combinations, including bus and car, using each of the two ferry routes.

### Halifax to St. John's: 1991 Costs

Overall total costs per passenger-trip are:

- $214 by airplane;
- $333 by car-ferry using the Port aux Basques ferry;
- $292 by car-ferry using the Argentia ferry;
- $181 by bus-ferry using the Port aux Basques ferry; and
- $150 by bus-ferry using the Argentia ferry.

*Table 18-4*

ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER IN 1991, 2000 "STATUS QUO" AND 2000 "DIRECTIONS" — ROUTE #4, HALIFAX TO ST. JOHN'S

| Dollars per trip, in 1991 dollars | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Airplane 1991** | | | **Airplane 2000 S-Q** | | | **Airplane 2000 D** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 25 | 21 | 46 | 25 | 7 | 32 | 24 | 0 | 24 |
| Environmental | 0 | 6 | 6 | 0 | 5 | 5 | 5 | 0 | 5 |
| Accident | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| Special tax/fee | 1 | −1 | 0 | 1 | −1 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 157 | 4 | 161 | 141 | 0 | 141 | 141 | 0 | 141 |
| **Total** | **184** | **32** | **214** | **168** | **11** | **179** | **171** | **0** | **171** |
| | **Car + P-a-B[a] Ferry 1991** | | | **Car + P-a-B[a] Ferry 2000 S-Q** | | | **Car + P-a-B[a] Ferry 2000 D** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 30 | 30 | 0 | 30 | 30 | 31 | −5 | 26 |
| Environmental | 0 | 9 | 9 | 0 | 8 | 8 | 7 | 0 | 7 |
| Accident | 48 | 1 | 49 | 43 | 1 | 44 | 44 | 0 | 44 |
| Special tax/fee | 15 | −15 | 0 | 15 | −15 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 181 | 64 | 245 | 178 | 64 | 242 | 198 | 20 | 218 |
| **Total** | **244** | **89** | **333** | **236** | **88** | **324** | **280** | **15** | **295** |
| | **Car + Argentia Ferry 1991** | | | **Car + Argentia Ferry 2000 S-Q** | | | **Car + Argentia Ferry 2000 D** | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 32 | 32 | 0 | 32 | 32 | 31 | −2 | 29 |
| Environmental | 0 | 12 | 12 | 0 | 12 | 12 | 10 | 0 | 10 |
| Accident | 18 | 0 | 18 | 16 | 0 | 16 | 16 | 0 | 16 |
| Special tax/fee | 6 | −6 | 0 | 6 | −6 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 150 | 80 | 230 | 148 | 80 | 228 | 167 | 25 | 192 |
| **Total** | **174** | **118** | **292** | **170** | **118** | **288** | **224** | **23** | **247** |

Table 18-4 (cont'd)

Illustrative Comprehensive Costs per Passenger in 1991, 2000 "Status Quo" and 2000 "Directions" — Route #4, Halifax to St. John's

| | Dollars per trip, in 1991 dollars | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Bus + P-a-B Ferry 1991 | | | Bus + P-a-B Ferry 2000 S-Q | | | Bus + P-a-B Ferry 2000 D | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 0 | 12 | 12 | 0 | 12 | 12 | 11 | 0 | 11 |
| **Environmental** | 0 | 3 | 3 | 0 | 3 | 3 | 3 | 0 | 3 |
| **Accident** | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 | 5 |
| **Special tax/fee** | 3 | -3 | 0 | 3 | -3 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 106 | 55 | 161 | 106 | 55 | 161 | 135 | 7 | 142 |
| **Total** | **114** | **67** | **181** | **114** | **67** | **181** | **154** | **7** | **161** |
| | Bus + Argentia Ferry 1991 | | | Bus + Argentia Ferry 2000 S-Q | | | Bus + Argentia Ferry 2000 D | | |
| **Type of cost** | Users | Others | Total | Users | Others | Total | Users | Others | Total |
| **Infrastructure** | 0 | 25 | 25 | 0 | 25 | 25 | 23 | 0 | 23 |
| **Environmental** | 0 | 5 | 5 | 0 | 5 | 5 | 4 | 0 | 4 |
| **Accident** | 2 | 0 | 2 | 2 | 0 | 2 | 2 | 0 | 2 |
| **Special tax/fee** | 2 | -2 | 0 | 2 | -2 | 0 | 0 | 0 | 0 |
| **Vehicle/Carrier** | 87 | 31 | 118 | 87 | 31 | 118 | 87 | 12 | 99 |
| **Total** | **91** | **59** | **150** | **91** | **59** | **150** | **116** | **12** | **128** |

a. Port aux Basques.

Note: In order to illustrate smaller components, route totals are shown to the nearest dollar. In general, cost estimates are not accurate to this level of precision. See text for qualifications.

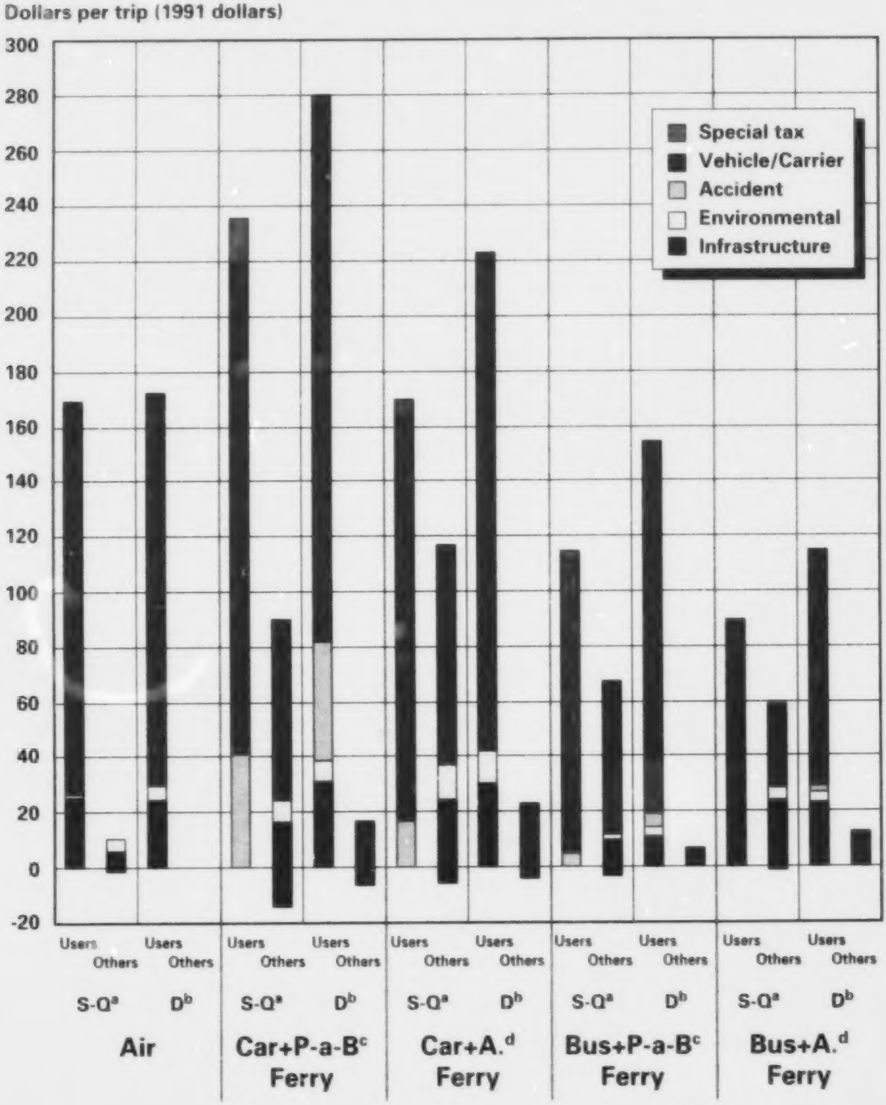
In more detail, they are:

*Airplane:* Users pay an average fare of $184 for this type of route. Taxpayers pay $21 for unrecovered airport and air navigation infrastructure costs, and the public bears $6 in environmental damage. One dollar is recovered in fuel tax, and air passengers on other routes pay $4 in a cross subsidy to vehicle/carrier costs. The total contributed by others is $30 per passenger.

*Car-ferry using the Port aux Basques ferry:* (For this and the following three trips, the text reports some costs for the modal segments that are not shown in the table.) Average costs per traveller for the road

Chart 18-4

## ILLUSTRATIVE COMPREHENSIVE COSTS PER PASSENGER, PROJECTED TO 2000, HALIFAX TO ST. JOHN'S



a. S-Q is status quo for year 2000.
b. D is with the recommendations in "Directions" implemented in 2000.
c. Port aux Basques.
d. Argentia.

Note: The chart is a graphic representation of Table 18-4. Any negative components of costs borne by others are represented by shifting the others bar below the zero line.[1]

segments of the trip are $213, of which $13 is borne by others in unrecovered infrastructure and environmental damage costs.

Others contribute considerably to the ferry portion of the trip. While a user pays $44 for the ferry, federal taxpayers contribute an estimated $8 for such infrastructure as coast guard and navigation aids on this route. In addition, the direct vehicle/carrier subsidy to the carrier from federal taxpayers is $64 per car traveller. Combining the car and ferry costs, travellers pay a total of $244 and others pay $89.

*Car-ferry using the Argentia ferry:* Costs for the road portions of the trip are $78; travellers pay all but $4. Of total ferry costs of $214, travellers pay $100 and others pay $80 in direct subsidy. In addition, others pay $24 in infrastructure costs and $10 in environmental damage for the ferry crossing. In combination, travellers pay $174 and others pay $118 of the total cost of $292 per passenger.

The Argentia route is advantageous to travellers to St. John's. It costs less than the Port aux Basques route when all car costs are included and eliminates 800 kilometres of driving. This route, however, costs the taxpayer more than the Port aux Basques route with current pricing and subsidy policies. Travellers currently pay less on the Argentia ferry route than if they were travelling by airplane, although the full costs per passenger for the trip are much lower by airplane.

*Bus-ferry using the Port aux Basques ferry:* To use this route, travellers must take a bus in Nova Scotia operated by a private carrier and cross Newfoundland on the Crown-owned CN Roadcruiser bus. Although we estimated the average fares from actual 1992 full-fare figures, the bus costs in the table are not those of any of the carriers involved but generic costs estimated from data for a number of carriers. Our table reflects a $33 vehicle/carrier subsidy from passengers on other routes and from bus carrier losses (borne by shareholders, which in CN's case is the federal government) and an estimated total bus fare of $99. The traveller pays $15 of the ferry service.

Taxpayers contribute $8 to marine infrastructure costs and pay a vehicle/carrier subsidy of $22. Including all components, total ferry costs are $46.

Combined fares for the bus and ferry portions of the trip are $114 paid by passengers, toward a total cost of $181 per passenger.

*Bus-ferry using the Argentia ferry:* Travellers also require bus service in Nova Scotia and Newfoundland for this trip. Both bus services are run by privately owned carriers; the Newfoundland run is much shorter than that required for travellers using the Port aux Basques ferry. The combined bus carriers' costs are estimated at $42 per trip, while the average bus traveller pays $45 in fares. Bus carriers use the extra $3 to cross subsidize passengers on other routes.

The traveller pays $42 in ferry costs. Taxpayers contribute $24 for marine infrastructure, and $34 in vehicle/carrier subsidies, for a total of $58. Together with environmental damage costs, total ferry costs are $106.

The combined fare for the bus and ferry portions of this trip is $91, while the total cost is $150.

### Halifax to St. John's: 2000 Status Quo

Air infrastructure costs per passenger would fall as traffic increased at a greater rate than spending on airports and air navigation services. Airplane and car costs would also decline slightly as fuel consumption and emissions decreased and road accident costs fell. Costs of the bus and ferry services would remain the same.

### Halifax to St. John's: 2000 Directions

When our recommendations are implemented, we expect the following changes in costs by mode:

*Airplane:* Airport and air navigation spending (infrastructure) would fall by 25 percent to $24 per passenger for this trip. Travellers would pay all costs, including charges for infrastructure and environmental damage. Total costs per passenger would decline to $171. The total costs in the 2000 D case are expected to be almost the same as the traveller costs in the 2000 S-Q case.

*Car:* Car costs would change in the same proportions as those on the other routes. Road infrastructure costs would fall because only part of the growth in traffic would be met by increases in capital and operating spending. This is represented as a 5 percent decrease in infrastructure costs. The fuel tax would be changed into a road infrastructure charge and would almost double in order to cover costs throughout the road network. This increase, plus the charge to travellers for environmental damage, would bring a 10 percent reduction in environmental damage costs and the fuel component of vehicle/carrier costs.

*Bus:* Deregulation would encourage efficiency in operations and remove cross subsidization. Privatization or contracting for operation of the government-owned Newfoundland service could also result in cost reductions.

*Ferry:* With full cost recovery for navigation services and with transparency of cost-related decisions, we expect total costs for water infrastructure to fall 10 percent. The federal government would ensure full cost recovery in ferry financing by decreasing vehicle/carrier subsidies over the next 10 years. By 2000, subsidies would be only 25 percent of their 1991 levels, with elimination of remaining amounts scheduled for 2002 if that were consistent with continuing to meet Constitutional obligations to ensure service. Management would be directed to focus on efficiency. As a result, we expect ferry costs to fall 20 percent. Further, ferry users would not be charged with any extra costs associated with requirements to construct vessels in domestic shipyards.

In summary, under our recommendations the overall costs of the air, car-ferry and bus-ferry services would decrease notably. Most of the others costs would be paid by travellers. Total users' charges would therefore increase relative to the 2000 S-Q case from:

- $168 to $171 for airplane;
- $236 to $280 for car-ferry costs on the Port aux Basques route;
- $170 to $224 for car-ferry costs on the Argentia route;
- $114 to $154 for bus-ferry costs on the Port aux Basques route; and
- $91 to $116 for bus-ferry costs on the Argentia route.

## TOTAL SYSTEM COSTS

Illustrating the effects of our recommendations on the four routes gives some idea of the way we expect our recommendations to affect travellers using different routes and modes. To understand how our recommendations would affect the economy and taxpayers in general, it is also necessary to attempt to approximate the total effects.

We have done this using three tables:

*Table 18-5:* Total costs for Canada's intercity passenger transportation system projected to the year 2000, presuming no substantial adjustment in current transportation policy (the 2000 S-Q case). The table includes the costs for each means of travel and for total intercity travel.

*Table 18-6:* Total costs projected to the year 2000 after governments implement our recommendations (the 2000 D case). The table includes the costs for each means and for total intercity travel.

*Table 18-7:* Shows the 2000 D costs less the 2000 S-Q costs; this is an indication of the impact of the recommendations on the costs for each means of travel and for total intercity travel.

The tables are set up in a similar fashion to those for the illustrative routes. For the different components of transportation costs (infrastructure, environmental, accident, special taxes/fees and vehicle/carrier), the first and second columns indicate who pays — users and others including both the taxpayers and the public. The third column is the sum of the first two. The amounts in all tables are in 1991 dollars.

## TOTAL COSTS IN THE 2000 STATUS-QUO CASE: TABLE 18-5

We based our calculations on simple projections of traffic growth from 1991 to 2000, consistent with those for the illustrative routes. For example:

- car and airplane travel will grow by 30 percent;[3]
- ferry travel will grow by 30 percent;[4] and
- bus and train travel will not change.[5]

As with the illustrative routes, we calculated total system costs to reflect the expectation that the average cost per passenger-kilometre will fall by the year 2000 due to trends in technology and traffic growth. For example (all references are per passenger-kilometre):

- fuel consumption will decrease by 13 percent for cars and 15 percent for airplanes;
- environmental damage from cars will drop by 20 percent, and from airplanes by 25 percent;
- accident costs for cars and buses will fall 10 percent;
- carrier operating costs for trains will be reduced by 5 percent;
- average costs of airport and air navigation infrastructure will decrease as use of the existing capacity grows; and
- ferry costs remain unchanged for the individual services, but the average declines slightly due to the faster growth in traffic on the lower cost services.

The result of these changes will be that total costs per passenger-kilometre fall by 3 percent for travel by car, 4 percent for train, 15 percent for airplane, 3 percent for ferry and remain unchanged for bus. Of course, with increases in traffic, the total amount spent on domestic passenger transportation will rise substantially between 1991 and 2000.

*Table 18-5*

ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL IN 2000 "STATUS QUO"

| Totals: $ millions, in 1991 dollars | | | | | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Car (270 billion pass-km)** | | | **Bus (3.3 billion pass-km)** | | |
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 0 | 5,769 | 5,769 | 0 | 10 | 10 |
| Environmental | 0 | 1,247 | 1,247 | 0 | 8 | 8 |
| Accident | 9,213 | 202 | 9,415 | 12 | 0 | 12 |
| Special trans. tax/fee | 3,199 | –3,199 | 0 | 9 | –9 | 0 |
| Vehicle/Carrier | 28,954 | 0 | 28,954 | 277 | 8 | 285 |
| **Total** | **41,366** | **4,019** | **45,385** | **298** | **17** | **315** |
| **Type of cost** | **Airplane (33 billion pass-km)** | | | **Train (1.4 billion pass-km)** | | |
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 723 | 701 | 1,424 | 45 | 0 | 45 |
| Environmental | 0 | 266 | 266 | 0 | 9 | 9 |
| Accident | 33 | 0 | 33 | 3 | 0 | 3 |
| Special trans. tax/fee | 165 | –165 | 0 | 6 | –6 | 0 |
| Vehicle/Carrier | 4,127 | 0 | 4,127 | 99 | 435 | 534 |
| **Total** | **5,048** | **802** | **5,850** | **153** | **438** | **591** |
| **Type of cost** | **Ferry (1.1 billion pass-km)** | | | **All intercity travel (310 billion pass-km)** | | |
| | Users | Others | Total | **Users** | **Others** | **Total** |
| Infrastructure | 0 | 52 | 52 | 768 | 6,532 | 7,300 |
| Environmental | 0 | 22 | 22 | 0 | 1,552 | 1,552 |
| Accident | 1 | 0 | 1 | 9,262 | 202 | 9,464 |
| Special trans. tax/fee | 10 | –10 | 0 | 3,389 | –3,389 | 0 |
| Vehicle/Carrier | 264 | 113 | 377 | 33,721 | 556 | 34,277 |
| **Total** | **275** | **177** | **452** | **47 140** | **5,453** | **52,593** |

**Note: In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision. See text.**

## TOTAL COSTS WITH OUR RECOMMENDATIONS IMPLEMENTED: TABLES 18-6 AND 18-7

The passenger transportation system would be fairer for all Canadians after our recommendations are implemented. Travellers would pay all the costs of their travel, including the costs of the damage they cause to the environment and of accidents. The result would be that most travellers would pay more for travel but this would be more than balanced by the reductions in what general taxpayers and the public would pay to support the passenger transportation system, reflecting a reduction in total costs — including environmental costs.

Putting our recommendations in place would cause changes in amounts of travel, varying by the means of transportation. With the increase in car and air costs to travellers, some reduction in use of these means is expected. With the increase in the price to the traveller of car and air travel, and reduction in price and improvement in service of main-route bus travel, some increase in use of the bus is expected. With only small percentage shifts from car and airplane to bus, more than a doubling in the use of intercity bus is entirely possible. Some increase in train travel on the remaining routes may be achieved through better service, in spite of the increase in fares. Ferry travel will tend to be reduced by higher fares, although it is not likely to be very responsive to price.

It is easier, however, to make and interpret cost comparisons under the assumption that traffic patterns and levels do not change from the 2000 S-Q to the 2000 D case. The figures in tables 18-6 and 18-7 for the different means of transportation are calculated using this assumption, with the exception that total train passenger-kilometres are reduced by 50 percent, reflecting our prediction that a number of passenger rail services would cease to operate as the subsidy is reduced. These figures are used in discussing changes in costs for the individual means of travel.

Table 18-6

### ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL IN 2000 "DIRECTIONS"

**Totals: $ millions, in 1991 dollars**

| Type of cost | Car (270 billion pass-km) | | | Bus (3.3 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 5,491 | 0 | 5,491 | 9 | 0 | 9 |
| Environmental | 1,122 | 0 | 1,122 | 6 | 0 | 6 |
| Accident | 9,414 | 0 | 9,414 | 12 | 0 | 12 |
| Special trans. tax/fee | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 28,480 | 0 | 28,480 | 237 | 5 | 242 |
| **Total** | **44,507** | **0** | **44,507** | **264** | **5** | **269** |

| Type of cost | Airplane (33 billion pass-km) | | | Train (1.4 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 1,133 | 40 | 1,173 | 32 | 0 | 32 |
| Environmental | 253 | 0 | 253 | 4 | 0 | 4 |
| Accident | 33 | 0 | 33 | 1 | 0 | 1 |
| Special trans. tax/fee | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicle/Carrier | 4,127 | 0 | 4,127 | 181 | 60 | 241 |
| **Total** | **5,546** | **40** | **5,586** | **218** | **60** | **278** |

| Type of cost | Ferry (1.1 billion pass-km) | | | All intercity travel (310 billion pass-km) | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | **Users** | **Others** | **Total** |
| Infrastructure | 47 | 0 | 47 | **6,725** | **40** | **6,765** |
| Environmental | 17 | 0 | 17 | **1,405** | **0** | **1,405** |
| Accident | 1 | 0 | 1 | **9,470** | **0** | **9,470** |
| Special trans. tax/fee | 0 | 0 | 0 | **0** | **0** | **0** |
| Vehicle/Carrier | 320 | 28 | 348 | **33,411** | **93** | **33,504** |
| **Total** | **385** | **28** | **413** | **51,011** | **133** | **51,144** |

Note: **In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision. See text.**

**Costs for means of travel do not sum to costs for all intercity travel, as the latter also includes allowance for costs of increased car, bus and airplane travel to replace assumed reduction in rail travel between 2000 S-Q and 2000 D cases. See text.**

## Table 18-7

## ILLUSTRATIVE SYSTEM-WIDE ANNUAL COSTS OF INTERCITY DOMESTIC TRAVEL, CHANGES BROUGHT BY IMPLEMENTING "DIRECTIONS" COMPARED WITH THE "STATUS QUO"

**Totals: $ millions, in 1991 dollars**

| Type of cost | Car | | | Bus | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 5,491 | -5,769 | -278 | 9 | -10 | -1 |
| Environmental | 1,122 | -1,247 | -125 | 6 | -8 | -2 |
| Accident | 201 | -202 | -1 | 0 | 0 | 0 |
| Special trans. tax/fee | -3,199 | 3,199 | 0 | -9 | 9 | 0 |
| Vehicle/Carrier | -474 | 0 | -474 | -40 | -3 | -43 |
| **Total** | **3,141** | **-4,019** | **-878** | **-34** | **-12** | **-46** |

| Type of cost | Airplane | | | Train | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 410 | -661 | -251 | -13 | 0 | -13 |
| Environmental | 253 | -266 | -13 | 4 | -9 | -5 |
| Accident | 0 | 0 | 0 | -2 | 0 | -2 |
| Special trans. tax/fee | -165 | 165 | 0 | -6 | 6 | 0 |
| Vehicle/Carrier | 0 | 0 | 0 | 82 | -375 | -293 |
| **Total** | **498** | **-762** | **-264** | **65** | **-378** | **-313** |

| Type of cost | Ferry | | | All intercity travel | | |
|---|---|---|---|---|---|---|
| | Users | Others | Total | Users | Others | Total |
| Infrastructure | 47 | -52 | -5 | 5,957 | -6,492 | -535 |
| Environmental | 17 | -22 | -5 | 1,405 | -1,552 | -147 |
| Accident | 0 | 0 | 0 | 208 | -202 | 6 |
| Special trans. tax/fee | -10 | 10 | 0 | -3,389 | 3,389 | 0 |
| Vehicle/Carrier | 56 | -85 | -29 | -310 | -463 | -773 |
| **Total** | **110** | **-149** | **-39** | **3,871** | **-5,320** | **-1,449** |

Note: In order to illustrate smaller components, figures are shown to the nearest $ million. In general, cost estimates are not accurate to this level of precision. See text.

Costs for means of travel do not sum to costs for all intercity travel, as the latter also includes allowance for costs of increased car, bus and airplane travel to replace assumed reduction in rail travel between 2000 S-Q and 2000 D cases. See text.

It would be inappropriate to compare total passenger transportation costs for all means of travel in the 2000 S-Q and the 2000 D cases on this basis, because no allowance is made for replacement of the reduced train travel. Thus the estimates for costs of all intercity travel in tables 18-6 and 18-7 are calculated using the illustrative assumption that the entire reduction in rail travel shifts to other means: car, bus and airplane travel are each increased by one third of the reduction in train passenger-kilometres.

### Car Travel

Drivers and owners will pay the full costs of travelling by car. The results:

- *Infrastructure:* Charges to users would be about $5.5 billion, replacing the special transportation taxes/fees, which we estimate at $3.2 billion for 2000 S-Q. This increase is the amount we expect (by our rough calculations) to be needed in the long term to recover all of the costs of building and maintaining roads, including the costs of land and an interest charge on capital. In addition, the total costs of roads will fall by about 5 percent ($278 million), relative to the 2000 S-Q case. In 2000 S-Q, we assumed that road infrastructure expenditures would be increased in proportion to traffic, but in the 2000 D case — where more careful scrutiny of the benefits and costs of expenditures would be given in improving and extending the highway network — we assume that expenditures will need to increase less than proportionately to traffic growth over this period.

Once our entire framework is in place, with investment decisions and pricing designed as we suggest, the annual revenues would, on average, equal the annual costs. In particular years, however, there might be substantial cash surpluses or cash requirements due to the irregularity of road construction. During early years, our proposed pricing based on the annual costs of the existing highway network might generate considerable cash surpluses. Such prices, however, would be intended to provide an appropriate measure of the long-run costs of the different means of passenger transportation, and to provide the road agencies with information on which to base investment decisions. Interim surpluses, not required for long-term network expansion, would represent a return to governments on past investment.

- *Environmental costs:* Car users will pay about $1.1 billion for the damage they cause to the environment. Emissions will decline due to decreasing fuel consumption, and environmental costs will fall by 10 percent ($125 million).
- *Accident costs:* Car users will pay directly for that portion of total accident costs previously borne by taxpayers through general taxes and/or health care premiums.
- *Vehicle/carrier costs:* These costs will fall by about 1.5 percent ($474 million) due to the reduction in fuel consumption.

The overall result of the implementation of our recommendations for car travel is as follows:

- users' costs will rise by $3.1 billion, or 8 percent;
- others will save $125 million because total environmental costs will decline by 10 percent, and about $1.1 billion which users will pay in environmental charges. Governments could use a part of the $1.1 billion for environmental clean-up and compensation, and the remainder (probably the larger part) to reduce general taxes. Others will also save $2.8 billion in previously hidden net subsidies (the excess of subsidies to infrastructure and accidents over special taxes); and
- total car costs will fall by $0.9 billion, or 2 percent.

It would be a natural extension to apply some or all aspects of the approach that we recommend for car travellers using highways, to cars using urban streets and secondary rural roads, and to trucks. The changes in costs for all users of all roads would be substantially larger than the changes discussed above.

**Bus Travel**

Competition among bus companies and discontinuation of cross-subsidized services on local routes where demand is insufficient to cover costs is projected to reduce carrier costs by 15 percent per passenger-kilometre.[6]

- *Infrastructure costs:* Charges to buses for use of roads are projected to be only slightly higher than the present special fuel tax. Per passenger-kilometre, costs should fall as average load factors improve.
- *Environmental costs:* These costs, and the charges to bus carriers, will amount to $6 million, or approximately 2 percent of total cost.

These increases in charges to bus travellers will be more than offset by decreases in bus carrier costs and therefore:

- bus traveller fares, which would now cover all infrastructure and environmental costs, will fall by 11 percent; and
- the total amount paid by others ($17 million) in 2000 S-Q will be reduced by $12 million, to $5 million in direct (transitional) subsidies.

**Airplane Travel**

Air carrier costs will remain the same, while changes in the operations of airports and air navigation services will stimulate innovation and efficiency. The costs of air travel are projected to change as follows:

- *Infrastructure costs:* Charges for airports and air navigation services paid by travellers will increase by about $400 million, or 1.3¢ per passenger-kilometre. Others will save about $650 million at this point in the phase-out of taxpayer subsidies. An 18 percent ($251 million) reduction in total airport and air navigation costs is projected.
- *Environmental costs:* Environmental charges and improved air traffic control are projected to achieve a 5 percent reduction in

emissions. Air travellers will pay about $250 million for the damage they cause to the environment.

The results of the implementation of our recommendations are that:

- travellers will pay $500 million, or 10 percent, more for airplane travel;
- costs of $750 million net of special charges, previously borne by taxpayers in airport and navigation service subsidies and by the public in environmental damage, will be eliminated; and
- total air travel costs will fall by 5 percent, or $250 million.

**Train Travel**

The rationalization of passenger rail service will be accompanied by a reduction of direct vehicle/carrier subsidies by others of $375 million. To the extent that the 2000 S-Q subsidies of $435 million include return on investment, and that rationalization may require write-offs and special payments, annual savings may be somewhat reduced in the short run from the levels shown.

**Ferry Travel**

Governments will phase out subsidies to ferry services over a 10-year period.

- *Infrastructure costs:* Transport Canada spending will decrease by 10 percent, with full cost-recovery from travellers. New charges to users will total $47 million, or $37 million more than the special tax/fee (fuel tax) that the charges replace.

- *Environmental costs:* Environmental charges will stimulate a 20 percent reduction in ferry emissions. Travellers will pay $17 million for the damage they cause to the environment.

Direct vehicle/carrier subsidies will fall by $85 million by 2000, leaving $28 million for subsidy for operations that year. East-coast ferry services, which require more subsidies than those on the west coast, will be the most affected by the transfer of taxpayer-supported ferry costs to ferry travellers.

Our recommendations will encourage increased efficiency:

- charges to ferry travellers will rise by 40 percent ($110 million);
- savings to others will total $149 million; and
- ferry costs will fall by 9 percent ($39 million).

**Total Intercity Travel**

With our recommendations in place, there will be a transfer of costs from taxpayers to travellers using the passenger transportation system. Allowing for the replacement of the least competitive half of rail passenger-kilometres by car, bus and air travel:

- *Users:* Travellers will pay $6.0 billion per year more in infrastructure charges, $1.4 billion in environmental damage charges and $200 million in accident charges. Travellers will save $3.4 billion in special taxes (mostly fuel taxes) and more than $300 million in vehicle/carrier costs. Total net costs for travellers will therefore increase by $3.9 billion.
- *Others:* General taxpayers will save $6.5 billion per year in subsidies for transportation infrastructure (mostly roads and airports). In addition, general taxpayers will gain $1.4 billion because of charges for environmental damage, some of which may be used to compensate for environmental damage losses. The public will gain about $150 million in reduced environmental damage. Others will also save $200 million in health care for accident victims. After subtracting $3.4 billion in revenues because special taxes on travellers no longer exist, and after including $500 million saved due to discontinuing subsidies to trains and ferries, the general taxpayer/general public saves $5.3 billion.

## CONCLUSION

Our illustrative estimates in this chapter have been intended to provide:

- an impression of the extent to which the change in how Canadians pay for transportation would raise costs to Canadians when they travel — on illustrative routes and in general — at the same time that it reduces costs to Canadian taxpayers; and
- an impression of the potential for reducing overall costs as a result of implementing our recommendations.

With all our recommendations in place, there will be annual savings in most types of transportation costs that could be in the order of:

- $500 million in infrastructure costs;
- about $150 million in environmental damage costs; and
- $800 million in vehicle use and carrier costs.

Total cost of intercity passenger travel would fall by 3 percent, or $1.4 billion per year.

# ENDNOTES

1. As set out in Endnote 1 to Chapter 3, for individual routes, cross subsidies as well as special transportation taxes/fees are potential negative components of others' costs.

   When users pay more than the vehicle/carrier costs (or — in the 2000 D case — than the infrastructure costs) associated with the route used, the excess is considered a contribution from users to others (other travellers). When this occurs, the base of the others bar is shifted below the zero line by an amount equal to the sum of revenues from special taxes and fees (a negative component of others costs) and of negative cross subsidies (cross subsidies available for other travellers).

   For example, for bus travel on the Toronto to Montreal route (Table 18-2 and Chart 18-2), in the 2000 S-Q case the others bar starts at -4, the sum of -1 from special taxes and -3 from cross subsidy.

   Only the positive components of others' costs are shown as explicit segments of the bar. For Toronto to Montreal bus travel, the positive components sum to 1, which is the vertical height of the bar above its -4 base.

   In a few cases for the individual routes, the negative components exceed the positive components of costs borne by others, resulting in negative net costs. In such cases, the top of the others bar, which indicates net costs borne by others, is below the zero line. For example, again for Toronto to Montreal bus in the 2000 S-Q travel case, Table 18-2 shows net costs borne by others of -3. The top of the others bar for bus travel in Chart 18-2 S-Q thus lies below the zero line at -3.

   As well, for car travel in certain of the 2000 D cases, the only non-zero component of others' costs appears in the infrastructure row, and is negative if infrastructure users on this route are paying "extra" to cover costs of lower volume routes. In other words they are covering a cross subsidy to car travellers on lower volume routes. In such cases, the others' costs are represented by a line that lies below the zero line at the level of (negative) net others' costs on this route. For example, the -5 infrastructure costs, and net costs, for others in Table 18-2 for car travellers from Toronto to Montreal in the 2000 D case, is represented by a line in Chart 18-2 lying below the zero line at -5.

2. The $35 shortfall below average cost does not mean that the carrier would be better off dropping the service. Rather, jet operations of this length do not contribute as greatly to airline fixed costs and profits as do longer journeys. There is competition from car, bus and train, as well as from other air carriers on routes of this type. Therefore, it is not surprising that profitability might be below the system average.

3. Growth of 30 percent to the end of the decade amounts to about 3 percent annually, consistent with what is believed (in the absence of national statistics) to have occurred in total car traffic during the 1980s; and consistent also with Transport Canada's prediction for domestic air passengers to 2000.

4. The annual number of ferry passengers grew between 1980 and 1988 by 10.5 percent on the east-coast services and by 46 percent on west-coast services.

5. These types of traffic have seen inconsistent fluctuations in the last two decades. For both, passengers carried increased in the late 1970s and early 1980s. A gradual decline followed in train traffic, with a sharp reduction in traffic following the service cuts in 1990. Bus traffic has also declined substantially since 1982.

6. This system average reduction of 15 percent differs from the 10 percent reduction assumed for the higher volume intercity routes shown in Tables 18-1, 18-2 and 18-4. The latter primarily reflects assumed reduction in average operations costs per passenger on given services. The assumed system average reduction, however, is also substantially influenced by the anticipated improvement in average load factor (passenger-kilometres per available seat-kilometre) across the system as a whole. This will result from the discontinuation of cross subsidized services, and particularly from schedules and the use of equipment better matched to lower volume routes.

# CHAPTER 19

# REACHING OUR DESTINATION: A PASSENGER TRANSPORTATION FRAMEWORK FOR THE 21ST CENTURY

## INTRODUCTION

In Chapter 4, we set out the foundations for a new passenger transportation framework. These foundations included a goal and four objectives along with principles for travellers, carriers and the providers of infrastructure — terminals, links and traffic control services. We also discussed the implications for governments and the transition mechanisms needed to help travellers, carriers and infrastructure providers adjust to a new framework based on these foundations.

In Chapters 5 to 16, we made recommendations that will enable governments to bring current passenger transportation policy into line with our goal, objectives and principles.

In this chapter, we repeat our principles from Chapter 4 and summarize our recommendations with respect to each principle. This provides a comprehensive list of the changes that we recommend. These changes, when implemented into laws, regulations and institutional adjustments, will result in a new passenger transportation framework for the 21st century. We conclude with a discussion on how these changes will meet our objectives.

## ACHIEVING OUR FRAMEWORK

In this section, we restate our principles and summarize the changes that we recommend for their implementation. We do not intend this list of changes to be a menu from which to pick and choose. Our recommendations are interrelated and their positive impacts must be combined to put our framework into effect.

## Paying the Full Costs of Travel

**Each traveller will pay the full cost of his or her travel, and travellers, in total, will pay the full cost of the passenger transportation system, including those costs related to protecting the environment, safety and accidents.**

**(Recommendation 4.3)**

Taxpayers will not subsidize travellers. Rather, travellers using a public mode of transportation will pay fares sufficient to cover their share of the carrier's full cost of providing services, including the cost of terminals, links and traffic control. Similarly, private-car and private-airplane operators will pay taxes or charges sufficient to cover their share of the full cost of terminals, links and traffic control. Travellers will also pay, through either a portion of their fare, a tax or a charge, for any environmental damage they cause and for all safety and accident costs associated with their travel.

Specifically:

- Charges for environmental damage will include the costs of clean-up and mitigation, administration of policies and regulations, compensation to those affected and a best estimate of damage where compensation cannot be made.
  (Recommendation 7.4)
- Where environmental goals have been established in the absence of reliable information on damage costs, governments will set environmental charges and/or regulations at a level expected to induce the behavioural change needed to meet such goals.
  (Recommendation 7.5)

- Charges for safety and accident costs will include the cost of safety services provided by governments, and health care costs currently borne by the health insurance system.
(Recommendation 8.1)

**Access for People with Disabilities**

**Travellers with physical or mental disabilities will have opportunities similar to those enjoyed by all Canadians to use public passenger transportation.**

**(Recommendation 4.4)**

While governments and industry have taken important steps to provide access to intercity passenger transportation services for people with disabilities, our approach will go further. Carriers and providers of infrastructure will be required to take greater responsibility to provide accessible passenger transportation.

Specifically:

- Governments will establish a goal that all travellers in Canada have access to public transportation in a safe, reasonably comfortable and dignified fashion, irrespective of physical or mental ability.
(Recommendation 9.1)
- Carriers and providers of infrastructure will decide how best to meet performance standards that provide improved accessibility for people with disabilities and will do this within a reasonable period of time.
(Recommendation 9.5)
- Carriers and providers of infrastructure will begin immediately to ensure that their specifications for new equipment and infrastructure provide continuing improvements in accessibility, and will

implement, where practicable, retrofitting programs for their equipment and infrastructure.
(Recommendation 9.3)

- Groups representing people with disabilities, carrier associations and the National Transportation Agency will jointly establish a mechanism, such as a coded identification card system, that will enable carrier personnel to quickly identify the kinds of services and facilities needed by each traveller with a disability, including whether or not the traveller requires an attendant for safety or other reasons.
(Recommendation 9.6)

- When the National Transportation Agency or a carrier decides that, for safety reasons, an attendant is needed during a trip to assist an individual with a disability, the attendant's fare will be borne by the carrier.
(Recommendation 9.8)

- Carriers will ensure that any personnel who might be required to assist travellers with disabilities are trained to deal with such travellers with sensitivity and understanding.
(Recommendation 9.9)

- Canadians with disabilities, governments, carriers and manufacturers, through advisory and coordinating groups, will ensure that new services, equipment and infrastructure adequately serve those for whom they are intended.
(Recommendation 9.11)

## CHANGES FOR CARRIERS

**Competition and market forces will be the prime agents in providing viable and efficient carrier services.**

**(Recommendation 4.5)**

Carriers will provide services in a competitive environment, operating under the same commercial principles, economic forces and general rules as other businesses.

Governments will make the entry of new competitors into all carrier services easier by eliminating or easing restrictions. All potential entrants that are "fit, willing and able" will have an opportunity to supply passenger carrier services and have access to terminals, links and traffic control so long as they are prepared to pay their share of the costs, as well as any costs they impose with respect to environmental damage, safety and accidents. As well, anyone providing a carrier service will be able to withdraw these services, without undue delay, subject to adequate notice.

Specifically:

- Federal, provincial and territorial governments will amend their legislation concerning the regulation of intercity buses to reduce entry restrictions to "fit, willing and able" criteria, and require only public notice of route abandonments and publication of schedules and fares.
  (Recommendation 13.1)
- The federal government and the Government of Alberta will amend their legislation to eliminate the 10 percent ceiling on individual holdings that currently applies to Air Canada and Pacific Western Airlines, the parent of Canadian Airlines International.
  (Recommendation 11.2)
- The federal government will invite Canadian air carriers to make public proposals for future international air route designations, with the air carrier offering the best package to be granted the route and the reasons made public, and Canadian air carriers will be allowed to sell designated international routes to one another.
  (Recommendations 11.3 and 11.4)
- Governments will abstain from making any financial contribution that is intended to ensure the survival of air carriers.
  (Recommendation 11.5)

- The federal government will amend legislation to make rail track accessible to all qualified passenger carriers who are willing to pay for what they use and will ensure that all such carriers have access to essential rail infrastructure and are treated equally in the movement of their traffic.
  (Recommendation 6.7)
- After a 10-year transition period, all passenger train routes will be unsubsidized and open to any carrier who is "fit, willing and able."
  (Recommendation 12.4)
- Airport and municipal authorities will cooperate to ensure unrestricted access to airports by all ground connectors who pay their share of the costs, and the federal government will similarly grant all ground connectors open access to federally owned airports and rail stations.
  (Recommendation 15.1)
- The federal government will require that all agreements for the sale or lease of federally owned transportation infrastructure include provisions that oblige the operating authority to grant open access to all intermodal connectors on equal terms and conditions.
  (Recommendation 15.2)

Under current international arrangements, if a Canadian air carrier is no longer owned and controlled by Canadians, its designation as a "national airline" and, consequently, its ability to fly international routes, can be challenged. Although restrictions on ownership do not apply to other modes, we propose to limit foreign ownership for the Canadian air carrier industry because of the current international regulatory regime.

Specifically:

- The federal government will retain the existing limits on foreign ownership and control of air carriers.
  (Recommendation 11.1)

- If faced with a potential reduction to only one major Canadian air carrier, the federal government will override limitations on foreign ownership and control for the explicit purpose of, and to the extent required to, ensure competition in the domestic market. (Recommendation 11.6)

## CHANGES FOR PROVIDERS OF INFRASTRUCTURE

**Terminals, links and traffic control services will be priced on a terminal-by-terminal, link-by-link and service-by-service basis.**

**(Recommendation 4.6)**

**Where there is sufficient competition, or where users are in a strong bargaining position with providers of terminals, links or traffic control services — and so long as there are appropriate charges for environmental damage, safety and accidents — competition and market forces will determine prices and investment decisions for passenger transportation infrastructure.**

**(Recommendation 4.7)**

**Where regulations are required, they will be designed to ensure that pricing and investment decisions will be similar to what would otherwise occur through competitive market forces.**

**(Recommendation 4.8)**

### Setting Prices

Travellers will only pay for what they use. Prices will reflect the travellers' or carriers' use of each terminal, link or traffic control service and will be designed to encourage neither over-use nor under-use. Travellers using only some parts of the system will not pay for the parts they do not use and from which they do not benefit. Where such prices will not recover the full cost, they will be adjusted to provide for full cost recovery in such a way as to minimize the loss of efficiency.

Specifically:

- Provincial and territorial governments and road agencies will consider conventional tolling systems when new or expanded limited-access highways are required, with tolls set to cover any costs of the road link in question that exceed those recovered by fuel taxes. (Recommendation 5.6)
- Provincial and territorial governments will institute weight-distance taxes for trucks as part of an overall road-financing program. (Recommendation 5.5)
- Airport operators will obtain their funding from site-specific charges on an airport-by-airport basis, rather than through an allocation from the Air Transportation Tax. Charges to travellers will reflect the commercial potential of the airport, not historical costs. (Recommendations 5.1 and 5.3)
- The operator of the air navigation system will obtain funding for the system by charging aircraft operators directly for their share of air navigation and air traffic control costs through charges that differ by type of flight, class of aircraft and value of benefits received, rather than through an allocation from the Air Transportation Tax. This system will replace the Air Transportation Tax. (Recommendation 5.7)

A decision to move to a link-by-link charge for the existing road system will be based, in part, on technological feasibility, administrative cost and public acceptability. Such a change will likely be gradual or come in stages, except for a limited number of new toll roads.

Specifically:

- Provincial and territorial governments will meet the costs of their highway system, and any agreed upon National Highway System projects within their borders, through fuel taxes and other charges. (Recommendation 6.6)

**Making Investment Decisions**

Investments will be made only in those projects in which benefits to travellers exceed costs, and that yield the highest level of benefits over costs, regardless of mode. In making investment decisions, all costs, including safety, accident and environmental costs, as well as interest on funds invested, will be taken into account. Adequate provision will be made for maintenance. New technologies will be considered along with existing technologies, and full consideration will be given to the potential for intermodal operations to contribute to efficiency and ease of travel.

Specifically:

- For transferring airports to Local Airport Authorities, the federal government's valuation of existing airport capital facilities will reflect the commercial potential of the facilities, not historical costs. (Recommendation 5.3)
- Governments or Local Airport Authorities will make airport investments on an airport-by-airport basis and will only make new airport investments where costs, including a return on investment, can be expected to be repaid through future revenues. (Recommendations 5.1 and 5.3)
- In determining the extent of restoration and upgrading of the national highway network, provincial and territorial governments will be guided by a comparison of benefits and costs on individual projects, rather than by uniform engineering standards. (Recommendation 6.4)

- Governments will invest in high-speed rail infrastructure only if the benefits to the passenger transportation system exceed the costs, and if taxpayers do not have to pay any operating subsidies. (Recommendation 12.6)
- Any railway company will be allowed to abandon any amount of track without a limit (see also Recommendation 6.9). (Recommendation 6.8)
- All responsible agencies, in evaluating safety improvements in different modes, will use comparable values for injury and loss of life. (Recommendation 8.2)

## CHANGES FOR GOVERNMENTS

### The Functions of Government

**Governments will be responsible for establishing policies in relation to the framework, setting and enforcing standards, gathering and reporting information to the public, ensuring a sufficient level of research, maintaining competition and regulating monopolies.**

**(Recommendation 4.9)**

Federal, provincial and territorial transportation departments will move towards being small policy-oriented departments. They will advise governments on policy with respect to government transportation agencies, establish guidelines for project evaluation, notably for the assignment of joint costs to modes and user classes, and will be responsible for taking a cross-modal view of transportation issues. To the extent that environmental and safety policies are tailored to transportation, rather than being of general application, transportation departments will be involved in the development of environmental and safety policies and charges with environmental and health authorities. The departments will shed most or all of their operating responsibilities outside of safety regulation.

Specifically:

- The federal government will transfer all remaining airports to Local Airport Authorities and/or to other types of local operators. (Recommendation 6.1)
- The federal government will convert the air navigation system from a departmental organization to either a Crown corporation or an independent institution. (Recommendation 6.2)
- Each provincial and territorial government will establish a Crown corporation, supplemented by an advisory group, to be responsible for providing roads more efficiently and making pricing and investment decisions more transparent. (Recommendation 6.3)

Government agencies might still be used to provide some carrier services and operate some infrastructure. They would, however, be expected to function without subsidies, and private-sector firms would in general be free to enter the market in competition with such government operators.

In carrying out their policy-making responsibilities, governments will take a long-term view. We expressed concern in our Interim Report, and do again in this report, about a possible loss of important railway corridors as railways streamline their operations and abandon track. Governments will ensure that valuable, irreplaceable corridors are not lost for future transportation use.

Specifically:

- Railway companies will offer abandoned rail rights-of-way, under a formal procedure, to governments and then to other railway companies before such rights-of-way can be converted to other uses. All levels of government will develop policies, based on explicit criteria, for deciding which corridors they wish to retain for future

transportation use and will ensure that land so acquired is maintained intact as a corridor.
(Recommendation 6.9)

The role of government as referee will be expanded, and governments will collect and publish improved data on the passenger transportation system.

Specifically:

- The federal government will review the *Competition Act* and related policy and, if required, will strengthen the powers needed to prevent anti-competitive practices in the intercity bus industry.
(Recommendation 13.2)

- The federal government will extend its regulations governing the anti-competitive practices of computer reservation systems beyond the air mode to take a multimodal approach.
(Recommendation 15.3)

- The federal government will establish the regulations under which any high-speed rail system will operate, including safety and environmental regulations.
(Recommendation 12.8)

- The National Transportation Agency will ensure that abandoned railway corridors are offered to governments or other railway companies at a reasonable price.
(Recommendation 6.9)

- The National Transportation Agency will take more active responsibility for ensuring that transportation services become more accessible to those with disabilities.
(Recommendation 9.4).

- The National Transportation Agency will establish minimum national standards of transportation accessibility for persons with disabilities.
(Recommendation 9.2)

- The National Transportation Agency will mediate disputes regarding the requirement for an attendant to accompany a traveller with a disability.
  (Recommendation 9.7)
- Provincial and territorial governments will implement more-uniform and adequate minimum accessibility standards for inter-city buses for travellers with disabilities, or, if that does not occur, the federal government will rescind its delegated responsibility for nationally applied accessibility standards to ensure more uniformity.
  (Recommendation 9.10)
- Governments will further develop travel and other transportation data for public use, and the federal government will publish an annual report card on the passenger transportation system.
  (Recommendations 16.2, 16.3 and 16.4)

Transferring operating functions from government departments to the private sector or independent agencies will considerably reduce government personnel and financial requirements. We expect that these functions will be carried out with fewer people and at lower cost than is currently the case. Small additional government resources might be required to carry out expanded refereeing functions and to collect improved data on the transportation system. In addition, as the bus industry is brought within the scope of competition review, the federal government may have to increase resources for competition policy. This increase, however, should be more than offset by reductions in the cost of provincial regulatory bureaucracies.

### The Responsibilities of Levels of Government

**Decision making authority of governments will be assigned to the level of government that is both closest to the people and most able to exercise such authority efficiently.**

**(Recommendation 4.10)**

We asked ourselves whether achieving our framework will be possible under the current allocation of responsibilities among levels of government for the different modes.

We recognize that the policies of one level of government regarding a mode for which it is responsible can affect other modes that are the responsibility of another level of government. As long as the affected modes are paying their way, however, this type of interaction is not inherently a problem.

Given current jurisdictional arrangements, good will, cooperation and coordination among levels of government are essential to achieving comparable treatment of different modes. Our framework can be implemented using a cooperative approach, and within existing jurisdictional arrangements.

Specifically:

- A National Highway System will be identified by the Council of Ministers Responsible for Transportation and Highway Safety and will be operated and maintained through cooperative action of provincial and territorial governments and/or their road agencies. (Recommendation 6.5)

Local or regional governments will take policy responsibility for environmental damage when the source and effects are local. Similarly, the federal government will take responsibility when environmental damage from one region affects other regions or countries.

Specifically:

- Local and regional governments will address low-level ozone problems, focussing on ozone non-attainment areas, using special regional regulations such as speed limits, periodic motor-vehicle emissions testing, and emissions surcharges at times of the year when low-level ozone is a problem.
  (Recommendation 7.1)

- The federal government will strive for international agreement on an effective strategy to control global warming, and will seek to harmonize domestic policies and taxes with those of the international community.
  (Recommendation 7.2)

### Treating the Modes Equally

**Governments will tax and regulate all modes equally.**

**(Recommendation 4.11)**

Governments will not treat the modes differently in terms of taxes, charges or regulations. Governments will collect taxes for general revenue purposes from all modes on the same basis, set charges to cover the efficient cost of providing services and facilities and use the revenues for that purpose, and apply charges and regulations equally to all modes to address the costs that transportation activities impose on society.

Specifically:

- All fuel taxes will be used for transportation purposes or as a means of charging for costs, such as environmental damage and health care system costs, caused by transportation.
  (Recommendation 5.4)
- Governments will apply environmental emissions charges equally to all modes and to non-transportation sources, on as close to a per-unit-of-emission basis as practical.
  (Recommendation 7.6)
- Governments will set regulations for the effective control of environmentally damaging emissions that impose similar obligations in terms of cost per unit of abatement on each mode, and that treat

non-transportation sources of pollutants similarly to transportation sources.
(Recommendation 7.3)

- Governments will separate revenues from environmental emission charges from revenues from other passenger transportation charges and use such funds to clean up the environmental damage, compensate those affected, or lower general tax rates. They will not use such funds to expand or maintain the passenger transportation system.
(Recommendation 7.7)

### Improving Accountability and Transparency

**Decision making will be transparent so that Canadians can understand why governments or their agencies make the passenger transportation choices they make, and so that those making decisions can be held accountable.**

**(Recommendation 4.12)**

Those responsible for making and applying the rules and for spending travellers' and taxpayers' money will be more accountable for their actions. Governments will improve accountability by making relevant information available to the public and by making it easy to understand.

Specifically:

- If agencies that are established to manage transportation infrastructure are monopoly suppliers, the level of government responsible will ensure that advisory bodies of travellers and other interested parties are created to counsel management on investment priorities, charging mechanisms and the prices needed to achieve self-sufficiency.
(Recommendation 16.1)

- Governments will clearly report to the public the amount of, and reason for, any continuing subsidies to carriers.
(Recommendations 12.5, 14.4 and 16.4)
- Governments will make public the benefits and costs of any high-speed rail project in which they invest or subsidize and will consult the public on the implication of such investments.
(Recommendation 12.7)
- Government will allocate resources, and provincial and territorial governments will cooperate with the federal government to ensure the further improvement and collection of travel and other transportation data, and the data will be made available to the public.
(Recommendations 16.2 and 16.3)
- The federal government will publish an annual report card on the passenger transportation system that will include information on the use of the system, subsidies, extent of cost recovery, and degree to which objectives are being met, as well as information on the reliability and safety of the passenger transportation system.
(Recommendation 16.4)

## TRANSITION REQUIREMENTS

**In cases where time is required to ease the problems caused by steep price adjustments, or where a carrier, a particular carrier service, a terminal or a link is given another chance to survive within the new framework, financial assistance will be designed to encourage adjustment.**

**(Recommendation 4.13)**

**If a carrier, a particular carrier service, a terminal or a link cannot survive despite a reasonable period of time for adjustment, the terminal or link will be closed or the service discontinued.**

**(Recommendation 4.14)**

Since the passenger transportation system that will result from our framework will differ from the current system, governments will give travellers, carriers and facility providers time to adjust. In this adjustment period, any remaining subsidy from the taxpayers will be:

- provided, where possible, to move people in the most efficient way, regardless of mode;
- provided and managed by the level of government that has responsibility for the mode in question;
- borne by taxpayers in the jurisdiction that makes the decision, not by other transportation users; and
- provided on a declining basis, for a reasonable adjustment period, and then terminated.

Even when they are given financial assistance and a reasonable time to adjust, some carriers or facilities might not be able to achieve commercial viability. In such cases, they will be closed down.

We recognize four cases in which governments may have to provide transitional subsidies.

Specifically, they are:

- *Airports:* Whenever applying our principles to airports, including all Transport Canada airports, will result in steep increases in average charges to travellers, governments will provide transitional subsidies to be phased out over 10 years. The initial level of subsidy will be based on the current operating subsidy and will be used for capital as well as operating expenditures or, if the airport is closed, for other local transportation purposes.
  (Recommendation 5.2)
- *Passenger rail:* The federal government will enact legislation to give VIA Rail a mandate to operate on a commercial basis, with the general subsidy having a sunset provision of 10 years. During this

period, VIA Rail will have greater freedom to manage, including investment decisions, route selection, service levels and pricing; will be allowed to compete for other services such as commuter services and transporting mail; and will be required to file and publish detailed annual operating plans and financial reports, including the costs and revenues related to individual routes. At the end of 10 years, all routes will be unsubsidized (see also discussion of remote services later in this section).
(Recommendations 12.1, 12.2, 12.3 and 12.4)

- *Intercity bus:* If necessary to avoid steep increases in bus fares on particular routes following the relaxation of economic regulation of the intercity bus industry, governments will provide transitional subsidies on a declining basis not to exceed 10 years.
(Recommendation 13.3)
- *Ferries:* If necessary to avoid steep increases in fares, governments will provide transitional subsidies not to exceed 10 years on individual ferry routes (see also discussion of constitutionally provided ferry services later in this section).
(Recommendation 14.1)

In some cases, governments might choose to continue subsidies to passenger transportation services that are not commercially viable. Such subsidies are not consistent with our framework and, in general, should not be maintained. If, however, governments continue to provide subsidies despite our recommendations, they will do so in such a way as to ensure that services are as efficient as possible. In addition, such subsidies will be provided from general tax revenues and not from charges to travellers.

Specifically with respect to:

- *Remote train service:* Governments may decide to continue providing passenger transportation service to some communities that currently have remote train service. In this case, governments will use the most efficient mode and carrier, and, if feasible, use competitive bidding to choose the mode and carrier. In addition,

governments will provide the subsidy in such a way that the subsidized carrier will bring passengers to transfer at the closest convenient point to a commercial, unsubsidized carrier.
(Recommendation 12.5)

- *Constitutionally provided ferry services:* The federal government may use subsidies, if required, to maintain constitutionally guaranteed ferry services. Except for the ferry service between North Sydney, Nova Scotia, and Port aux Basques, Newfoundland, for which there is a constitutional limit on rates, continuing taxpayer subsidies to other ferry services will be no higher than required to maintain the service. In the case of the Nova Scotia to Newfoundland service, and any other constitutionally guaranteed services that require taxpayer subsidies to continue, the federal government will strive for the highest degree of cost recovery consistent with the constitutional obligations, and may offer the affected province a federal grant instead of the subsidy.
(Recommendation 14.2)

## MEETING OUR OBJECTIVES

In Chapter 4, we stated that the goal of the passenger transportation system should be to move people to where they want to go, and we proposed:

**Four guiding objectives:**

- **safety;**
- **protection of the environment;**
- **fairness to taxpayers, travellers and carriers; and**
- **efficiency, so that services are provided only where benefits to the individual traveller equal or exceed the cost, and given levels of service are provided at the lowest possible cost.**

**(Recommendation 4.1)**

We also concluded that:

**Governments pursue nation-building and regional development objectives through other programs rather than using the passenger transportation system.**

**(Recommendation 4.2)**

Our recommendations will create a passenger transportation system that is safe, that is more protective of the environment, that ensures fairness to taxpayers, travellers and carriers, and that operates more efficiently.

## IMPROVING SAFETY

We are encouraged by long-term trends in transportation safety, which show impressive improvements in all modes. We also recognize that safety improvements demand innovation — new technologies and new attitudes and behaviour by carriers and travellers. Our framework encourages such innovation.

### Government Regulations

Governments have been responsible for many safety improvements: in vehicles, by regulating vehicle performance; and in infrastructure, by adopting design standards. We recognize that such actions have generally been effective, and our framework reaffirms the role of government in maintaining the safety of the system through regulations. Our recommendations will strengthen the role of governments in providing objective analysis of accident trends and potential safety measures. Further, we have recommended that governments use comparable values for injury or loss of life for all modes when they establish regulations or invest directly in transportation infrastructure. This will help achieve a coordinated approach to safety among branches and levels of government.

### Using Charges to Change Behaviour

The payments that carriers and travellers already make toward accident costs, either directly or through insurance systems, have provided strong incentives for personal and corporate improvements in safety and have contributed to overall long-term improvements. Currently, however, carriers and travellers do not pay all the costs associated with accidents and safety prevention programs. Under our framework, governments will encourage greater safety by:

- making the safety costs of transportation as transparent as possible;
- ensuring that travellers and carriers pay all the costs of accidents by having provincial and territorial health-insurance systems reclaim all costs of treating accident victims from companies insuring vehicles and carriers; and
- ensuring that travellers and carriers pay all prevention costs by charging travellers and carriers directly for the costs of government transportation safety programs, such as emergency rescue services, police traffic enforcement and the administrative costs of regulating safety. In addition, users will pay for the safety components built into infrastructure by means of appropriate pricing for such infrastructure.

### Conclusions on Safety

We are convinced that when travellers and carriers face the full costs of accidents and safety programs, they will change their behaviour to reduce accidents. We also expect that the discipline involved in objectively assessing risks, evaluating safety measures, and providing accountability and transparency in setting charges will encourage governments to treat the modes with greater consistency, thereby getting the most safety improvement per dollar spent.

## GREATER PROTECTION OF THE ENVIRONMENT

Efforts to protect and improve Canada's environment have moved forward on many fronts in recent years. Public support for environmental programs has grown, encouraging increases in government spending and the regulation of individual and corporate activities. In addition, governments have attempted to coordinate their activities through the Canadian Conference of Ministers of the Environment, and the federal government has cooperated with other countries in environmental protection.

### Government Regulations

Under our framework, current regulatory controls will continue where they are cost-effective and will apply to all modes equally. Coordination among governments will be further improved by using common standards for environmental costs when evaluating regulations and investments in transportation infrastructure.

### Using Charges to Change Behaviour

In a more radical addition to the current approach, our principles call for travellers, carriers and providers of infrastructure to pay the environmental costs of travel and transportation investments. Making the environmental consequences of transportation obvious through transparent charges will considerably improve the strength and consistency of efforts to protect the environment. Carriers and travellers will take environmental damage into account in a consistent way when making transportation decisions.

Carriers and travellers will make such decisions by applying the same benefit-cost test that governments will apply in their decisions on regulations and public investments — that is, they will ask "Is the benefit worth the cost?" Since carriers and travellers will be using a common set of valuations of environmental damages — the same set as used by governments in their environmental decisions — consistency and efficiency in achieving environmental goals will be promoted. Governments will not need to predict where and how carriers and travellers should achieve reductions. The decisions can be left to users.

We are aware that the ability to measure environmental damage and assess its costs is limited and that (as in the case of other ill-defined risks) misperceptions of possible effects of preventive actions lead to a great range of public opinions — from indifference to strident demands for the strongest measures. We also recognize that political agreements on national goals might themselves be based on misperceptions. We argue strongly that governments ensure that the scientific evidence for environmental problems and solutions, and the most objective assessment of such evidence, be disseminated to the public as widely as possible.

Under our framework, governments will use revenues from environmental charges to clean up damage and to compensate those affected by such damage. Substantial surpluses, however, will remain. For example, governments will gain revenues from carbon dioxide ($CO_2$) emission charges, but it is unlikely that people at risk from global warming will be identified or compensated individually. Governments will use surplus environmental revenues to benefit all Canadians by reducing general taxes.

### Conclusions on Protecting the Environment

We recommend that travellers and carriers pay the costs of the damage they impose on the environment. We base this recommendation in part on the belief that users are generally able to affect the amount of damage they cause by their choice of vehicle or amount and type of travel.

We also believe that environmental charges will make the passenger transportation system more fair by guaranteeing that users provide compensation to taxpayers for the environmental costs that their use of the passenger transportation system imposes. Those who travel less will not pay the environmental costs imposed by those who travel more. Carriers and others who save money by using more-polluting vehicles will not gain an automatic competitive advantage over those who invest in pollution reduction. Travellers and carriers in the various modes will not be subject to different regulatory standards.

While our recommendations call for radical change, we believe they are rational, fair and will achieve national environmental goals efficiently and at a lower overall cost.

## GREATER FAIRNESS TO TAXPAYERS, TRAVELLERS AND CARRIERS

Our recommendations are guided by the objective of fair treatment for all Canadians. In general, under our framework, transportation policy will be neutral in its treatment of individuals and identifiable groups of individuals, favouring none above others, and favouring no group identified by region or by shared activities. All Canadians will have access to the transportation system on the same terms.

Specifically:

- governments will remove any barriers that prevent "fit, willing and able" carriers from entering transportation markets and getting access to essential facilities;
- governments will not favour travellers over non-travellers by providing large subsidies to some travellers; and
- governments will treat carriers and travellers in different modes equally.

### Special Circumstances

We recognize three special circumstances in applying these general rules of fairness:

- *People with disabilities:* Under our framework, travellers with physical or mental disabilities will have opportunities to use public passenger transportation that are similar to those enjoyed by all

Canadians. Carriers will make a sufficient proportion of their new intercity transportation vehicles accessible to people with disabilities, and will ensure that travellers with disabilities are treated with sensitivity and understanding.

- *Constitutionally provided ferry services:* The federal government is obliged under the Constitution to assume responsibility for certain ferry services and, in one case, to maintain a limit on rates. Governments will apply our recommendations on the management of infrastructure, and may institute competitive tendering to carriers for these ferry services. The result will be services provided in as cost-effective a manner as possible, thus reducing the amount of taxpayer support required.
- *Certain non-viable facilities and services:* There may be circumstances in which governments decide that a commercially non-viable transportation facility or service should be provided or guaranteed. Again, governments will apply our recommendations on the management of facilities, and may institute public competitive tendering to carriers for these facilities and services. This will reduce subsidies.

### Eliminating Subsidies

In general, subsidies from taxpayers and transportation users to certain groups of travellers are unfair — for example, air travellers being supported by non-travellers for the costs of air navigation systems and airport expenses or train travellers being supported by direct subsidies from taxpayers for their ticket. This unfairness is compounded by its effect on travel behaviour. Subsidies from taxpayers make some transportation services cheaper, encouraging travellers to use them more and — to the extent that the subsidy is above the average for transportation — causing travellers to switch from other modes. Such subsidies to one mode are unfair to other modes that could offer competing services.

The remedy is straightforward. Under our framework, carriers, and ultimately travellers, will pay all of the costs of infrastructure and services. This remedy will also apply to those modes that receive large subsidies — passenger train services and those ferry services for which there are no constitutional obligations. For example, our estimates show that passenger train services receive payments from taxpayers far in excess of fares received from travellers, while the public gains little if anything in terms of environmental improvement from these large expenditures. Such subsidized train services also compete unfairly with services provided by other modes, particularly intercity bus carriers.

Appropriate charges for environmental damage will also make the transportation system more fair than it is at present, even where there are no simple administrative systems for identifying those who bear the damage and for providing them with compensation. Where the evidence shows that the environmental damage differs substantially by region, as is the case with low-level ozone, and if feasible administratively, it would be fairer to differentiate the charges by region.

### Conclusions on Fairness

Under our framework, the goal of the passenger transportation system is to move people to where they want to go. Taxpayers should not be required to support one mode when a cheaper mode is available. Such support is unfair to taxpayers and to the operators and users of the other modes.

## A MORE EFFICIENT TRANSPORTATION SYSTEM

### Competition and Innovation

The passenger transportation system will be made more efficient, delivering better service at lower costs, through reforms in management, pricing policies and investment decision making.

We are convinced that competition will spur innovation. Our recommendations, therefore, introduce competition wherever possible: competition among modes, among carriers within modes and, where relevant, among providers of facilities. For example, improving ease of entry by bus carriers will reduce costs and fares, improve services on trunk routes and allow lower-cost operations to offer new services to smaller communities. Ensuring that competing carriers get access to air and bus terminals, train stations and computer reservation systems will encourage innovation and cost-cutting, to the benefit of all travellers.

In addition, our recommendations on the transparency of the budgeting processes of agencies, and on advisory roles for users of infrastructure provided by agencies, will encourage providers of infrastructure that are not subject to much direct competition to continually seek innovations that improve service and lower costs.

### Commercialization of Services

Putting transportation infrastructure and carriers on a more commercial basis will lower costs and improve services to carriers. For example, commercialization of air navigation services will free management to pursue innovation and improved efficiency.

For constitutionally guaranteed ferry services and for any remote train services that governments judge to require continuing taxpayer support, tendering by open contracts will allow competing operations to demonstrate their efficiency. It will also provide travellers and taxpayers with the best service at the least cost.

### Pricing and Investment

Requiring travellers to pay the full costs of their travel and removing taxpayer subsidies are important components of our proposals for efficiency. Equal treatment of modes and carriers means that users pay prices that represent the true costs of services, with no hidden contribution from others such as taxpayers and victims of environmental damage.

Our recommendations for pricing and investment are intended to achieve efficiency in the transportation system. Carriers and infrastructure providers will design efficient pricing systems, subject to the requirement that they recover all costs. With appropriate pricing in place, travellers and carriers will make decisions that maximize the benefits from travelling. Similarly, consideration of social costs and benefits, without regard to mode and jurisdictional limits, will guide agencies in setting priorities for investments in public transportation infrastructure.

### Conclusions on Efficiency

As we have emphasized throughout this report, efficiency is achieved whenever Canadians make the most of the resources that are devoted to transportation, and devote the amount of resources to transportation that wastes neither opportunities nor money. An efficient transportation system is one that contributes the most to Canadians' standard of living.

## REACHING OUR DESTINATION

No one can predict the future with any accuracy. In looking ahead, we see many changes that could affect intercity passenger transportation. For example, the environmental costs of transportation-related pollutants may prove substantially higher or lower than currently estimated, public demand may shift toward the train or the bus, and new technology may expand road capacity, reduce the environmental costs of car use, and make air travel cheaper. The possibilities for change are infinite.

What we set out to do was to develop principles under which travellers, carriers and governments will achieve what we believe are widely held objectives in a broad range of circumstances. Our principles will ensure a framework in which costs are reflected in prices paid by travellers, and institutions are flexible and responsive. This framework will constrain transportation activities that become too costly relative to benefits provided, and will encourage the transportation industry to take advantage of new opportunities resulting from improved technology and other favourable developments.

# APPENDIX A

## ORDER IN COUNCIL

P.C. 1989-2096

Certified to be a true copy of a Minute of a Meeting of the Committee of the Privy Council, approved by Her Excellency the Governor General on the 19th day of October, 1989.

The Committee of the Privy Council, on the recommendation of the Prime Minister, advise that a Commission do issue under Part I of the Inquiries Act and under the Great Seal of Canada appointing:

Louis Davies Hyndman of Edmonton, Alberta
Marie-Josée Drouin of Montreal, Quebec
Susan A. Fish of Toronto, Ontario
Marc Gaudry of Montreal, Quebec
William P. Kelly, C.M., of Ottawa, Ontario
John B. Hamilton, Q.C. of Toronto, Ontario
John Forbes Helliwell of Vancouver, British Columbia
James D. McNiven of Halifax, Nova Scotia
Dr. Maurice LeClair, O.C., M.D., of Westmount, Quebec

together with such other persons as may be named from time to time, to inquire into and report upon a national integrated inter-city passenger transportation system to meet the needs of Canada and Canadians in the 21st century and to ensure that transportation links among Canada's regions and communities are maintained and improved; and

The Committee also advise that the study include an examination of

(a) the role of a national integrated inter-city passenger transportation system, in the context of

- the relationship of the inter-city passenger system with the whole transportation system;
- the current extent and state of Canada's inter-city passenger transportation system;
- demographic and population trends;
- social trends and user preferences;
- technological developments in the transportation industry;
- international transportation developments and how they could impact on Canada's competitiveness;
- the economic prospects for the Canadian economy and their likely impact on inter-city passenger transportation requirements;
- the mobility needs of Canadians;

...2

(b) the structure of a national integrated inter-city passenger transportation system for transportation by air, marine, highway and rail and the relations among the modes, taking into account

- the means to encourage Canadians to travel within Canada;
- the appropriate mix among the various modes so as to maximize the effectiveness, efficiency and competitiveness of the system;
- the financial implications of such a system, including initial capital requirements as well as the cost of maintaining and operating the system;
- the promotion of energy efficient means of transportation;
- the environmental impact of various options in order to achieve a balance between the environmental impact and the transportation needs of Canadians;

(c) the potential for and the constraints on achieving a national integrated inter-city passenger transportation system by

- advising on the institutional arrangements required, including any arrangements needed to rationalize and coordinate the respective roles of the three levels of government in Canada in the provision of inter-city passenger transportation services;
- examining the relevant labour relations environment;
- assessing the transportation industry-government interface;

.../3

(d) the appropriate financial arrangements to achieve a national integrated inter-city passenger transportation system by

- taking into account the jurisdictions of the different levels of government and the role of the private sector;
- taking into account the overall cost to Canadians;
- considering the concept of appropriate user shares;
- examining means of attracting private financing to major transportation projects; and

The Committee also advise that the Commissioners

(1) be authorized to adopt such procedures and methods as they may from time to time deem expedient for the proper conduct of the inquiry and to sit at such times and in such places as may be required;

(2) be authorized to rent such space and facilities as may be required for the purposes of the inquiry, in accordance with Treasury Board policies;

(3) be authorized to engage the services of such experts and other persons as are referred to in section 11 of the Inquiries Act, at such rates of remuneration and reimbursement as may be approved by the Treasury Board;

(4) be directed, within the ambit of their work, to seek the views of all provincial and territorial governments as well as interested Canadians from all walks of life and all regions of the country;

(5) be directed to submit an interim report to the Governor in Council in both official languages not later than eighteen months from now;

(6) be directed to submit a final report to the Governor in Council in both official languages with all reasonable dispatch but no more than three years from now;

.../4

(7) be directed to file the records and papers of the inquiry as soon as reasonably may be after the conclusion of the inquiry with the Clerk of the Privy Council; and

The Committee also advise that Louis Davies Hyndman of Edmonton, Alberta, and Marie-Josée Drouin of Montreal, Quebec, be the Chairman and Vice-Chairman respectively of the Commission; and

The Committee further advise that Janet Smith of Ottawa, Ontario, be appointed Executive Director of the Commission.

CERTIFIED TO BE A TRUE COPY    COPIE CERTIFIÉE CONFORME

CLERK OF THE PRIVY COUNCIL    LE GREFFIER DU CONSEIL PRIVÉ

# APPENDIX B

## COMMISSION STAFF* AND SPECIAL ADVISORS

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# Volume

# 2

# DIRECTIONS

## THE FINAL
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## THE ROYAL
## COMMISSION
## ON NATIONAL
## PASSENGER
## TRANSPORTATION

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# INTRODUCTION TO VOLUME 2, AND RELATION OF VOLUME 2 TO THE ROYAL COMMISSION'S RESEARCH PROGRAM

Volume 2 is organized as a set of Notes to Chapters 1, 2, 3, 6, 7, 8, 9 and 18 of Volume 1. The primary purpose of these notes is to explain more fully, and to document, the estimates of the amounts and costs of intercity passenger travel that were developed for this report and are used in Volume 1. Such estimates figure prominently in the analysis of current and potential future passenger transportation costs in Chapters 3 and 18 of Volume 1, in the discussion of environmental impacts of transportation in Chapter 7, and in the discussion of the accident records of the different modes of transportation and of accident costs in Chapter 8. Estimates developed by Royal Commission staff are also used in the reference to total resources devoted to transportation in Chapter 1, and, in Chapter 2, to the amounts of intercity travel by various modes, currently and historically in Canada and in other countries.

In addition, Volume 2 provides supporting material for the section on rail infrastructure in Volume 1, Chapter 6, and for the discussion of legislation, regulations and other developments relevant to the provision of transportation for people with disabilities in Volume 1, Chapter 9.

Many of the estimates developed for this report and used in Volume 1 are inevitably quite rough, and in some cases are based on particular assumptions where alternative assumptions would also have been defensible. The relevant sections of Volume 2 do not quantify the margins of uncertainty to which the various estimates are subject. It is hoped, however, that the presentation and discussion of the approaches used in developing the estimates will allow the reader to form a general impression of the margin of uncertainty, and of the sensitivity of the estimates to key assumptions.

In some cases the notes to a chapter are presented as an integrated discussion of the development of the quantitative estimates in that chapter. In other cases, the notes deal with a series of relatively independent points in the chapter. A detailed table of contents precedes each of the sets of chapter notes.

A substantial part of the contracted research, and of the staff research work, carried out for the Royal Commission contributed to the development of the estimates, particularly the comprehensive cost estimates for the different modes of intercity transportation. Volumes 3 and 4 contain 22 of the research papers prepared for the Royal Commission that were judged to be particularly relevant to the issues discussed in Volume 1 and/or to be of interest to a significant number of readers in the transportation field. In some cases, sections of Volume 2 build on material from papers in Volumes 3 and 4. Some research papers in Volumes 3 and 4 provide a self-contained development of certain estimates and analyses referred to in Volume 1, particularly in Chapters 11, 12 and 13. No further supporting material is provided for these chapters in Volume 2. Several of the papers in Volumes 3 and 4 are summaries of historical, analytical or empirical work that provide a general discussion of issues of interest to the Royal Commission, and are relevant to one or more chapters in Volume 1.

These papers are listed below in the order in which they appear in Volumes 3 and 4.

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| Ron Hirshhorn | The Effects of U.S. Airline Deregulation: A Review of the Literature |
| Richard Lake,<br>L. Ross Jacobs and<br>S. T. Byerley | An Analysis of the Canadian Intercity Scheduled Bus Industry |
| Charles Schwier and<br>Richard Lake | VIA Rail Services: Economic Analysis |
| A. Cubukgil,<br>S. Borins and<br>M. Hoen | Airport Investment and Pricing Policies |

### Other

| | |
|---|---|
| Eric J. Miller and Kai-Sheng Fan | Travel Demand Behaviour: Survey of Intercity Mode-Split Models in Canada and Elsewhere |
| Richard Laferrière | Price Elasticities of Intercity Passenger Travel Demand |
| Ken McKenzie, Jack Mintz and Kim Scharf | Differential Taxation of Canadian and U.S. Passenger Transportation |
| Richard Lake | Notes on Intercity Passenger Transportation Technology |

Several other research papers prepared for the Royal Commission, judged to contain material potentially of use to a more limited number of readers with specialized transportation interests, are being made available in an unpublished research report series that will be distributed to libraries specializing in transportation and to large university and public libraries. These reports are:

| | **Author** | **Title** |
|---|---|---|
| RR-01 | Hickling Corporation | Transportation for People with Disabilities: A Policy Review and Analysis |
| RR-02 | Peat Marwick Stevenson & Kellogg | Intercity Passenger Bus Regulation in Canada |
| RR-03 | Michael K. Berkowitz | The Potential for Competition in Rail Carriage |
| RR-04 | Sypher : Mueller International Inc. | Air Infrastructure Costing |

| | | |
|---|---|---|
| RR-05 | Pilorusso Research & Consulting Inc. | The Cost of Inter-City Travel by Private Motor Vehicle |
| RR-06 | Hickling Corporation | Regulatory Reform in the Intercity Bus Industry: An International Comparison |
| RR-07 | William A. Sims | Externality Pricing |
| RR-08 | Tae Hoon Oum and Chunyan Yu | An International Comparison of the Economic Efficiency of Passenger Railway Systems |
| RR-09 | Geoplan Consultants Inc. | Canadian Ferry Costs and Industry Analysis |
| RR-10 | Richard J. Schultz | Airline Subsidies: Three Case Studies |
| RR-11 | M. Brenckmann | Technological Innovation in Transportation R&D Funding Policy and Approach |
| RR-12 | ADI Limited | Analysis of National Highway System Proposals |
| RR-13 | Ron Hirshhorn | The Ownership and Organization of Transportation Infrastructure — Roads and Airports |
| RR-14 | Robert Leore | Intercity Passenger Transportation Data Compendium |

A number of additional reports were prepared by contractors and Research Division staff. These are included in the Royal Commission material transferred to the National Archives. Several of these papers were prepared relatively early in the Royal Commission's work program and were used as inputs in subsequent work.

# NOTES TO CHAPTER 1:
# RESOURCES DEVOTED TO TRANSPORTATION

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# INTRODUCTION

Chapter 1 of Volume 1 states that in 1989 Canadians devoted resources equal to about 16% of the gross domestic product (GDP) to transportation, of which about 5% to 7% of GDP — depending on how broadly intercity travel is defined — was for intercity travel. These Notes to Chapter 1 introduce the concept of resources devoted to transportation, and sketch the way in which the estimates were derived.

The concept — total resources devoted to the transportation function or activity — is a very broad, and somewhat unconventional, measure of the size of transportation in the economy. It is used by the United States Department of Transportation (*National Transportation Statistics,* 1990, figure 1, p. 4) and the Eno Foundation (*Transportation in America,* 8th edition, May 1990, pp. 5-6) in discussions of transportation in the United States economy. A very similar concept was recently used in an article by Pierre Zalatan and Jean-Pierre Roy of Transport Canada ("The Importance of Transportation in the Canadian Economy," *Evolution in Transportation; Proceedings of the 26th Annual Meeting of the Canadian Transportation Research Forum,* Quebec City, May 1991, pp. 422-435).

The concept is somewhat unconventional because it includes resources devoted to production both of transportation services that are components of final demand, and transportation services (especially freight) that are intermediate inputs used in the production of other goods and services. Although the concept of total resources devoted to the function of transportation is of interest in arraying information on transportation resource use, it is important to recognize the consequences of including both final and intermediate activity.

If parallel estimates were made of the total resources devoted to a range of other major functions or activities in the economy — for example, to manufacturing, distribution, health care, education, public administration and so on — as well as to transportation, the total resources devoted to all these functions could well exceed the conventional measure of the total use of resources in the economy —

the GDP. This is because transportation, as well as being a final product, is an input in most of the other functions including manufacturing, education and health care. Similarly, goods or services produced by several of the other functions are used in carrying out the transportation function. The notion of total resources devoted to an economic function or activity departs from standard national income and expenditure accounts concepts, which generally focus either on final uses (rather than final plus intermediate uses) of goods and services, or on value added by (rather than total resources devoted to) economic activities or "industries." The National Accounts thus avoid counting use of resources more than once when displaying data on the full range of economic activities.

## 1. THE ESTIMATES

The special nature of the estimates of total resources devoted to transportation having been acknowledged, their derivation will be sketched. The objective is to obtain rough estimates of resources devoted to transportation; thus approximate procedures are used at a number of stages. In addition, to the extent possible, the estimates in this section use published data directly. In this they differ from some of the cost estimates in Chapter 3 of Volume 1 where attempts are made to quantify concepts that are judged to be important when comparing comprehensive costs of the different modes of transportation, but for which standard published data are not currently available.

Because individuals, businesses and governments are all involved both in purchasing transportation services and in directly using resources for transportation purposes, it is necessary to assemble data and estimates from a variety of sources to obtain an estimate of total resources devoted to transportation. Table 1(2)-1 shows four broad components of use of resources for transportation purposes:

I. Transportation services produced by business for sale (carrier revenues);

II. Transportation services produced by businesses for their own account — excluding business use of cars;

III. Own account car expenditures; and

IV. Government capital and operating expenditures to support transportation.

*Table 1(2)-1*

*RESOURCES DEVOTED TO TRANSPORTATION, 1980–1989*

*($ BILLIONS, CURRENT DOLLARS)*

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **I. Transportation services produced by businesses for sale (carrier revenues including government payments to carriers)** | | | | | | | | | | |
| 1. Air | 4.0 | 4.6 | 4.7 | 4.7 | 5.1 | 5.6 | 6.0 | 6.4 | 7.1 | 7.9 |
| 2. Rail | 5.3 | 6.1 | 6.3 | 7.0 | 7.6 | 7.7 | 7.6 | 7.9 | 8.0 | 7.4 |
| 3. Marine | 1.8 | 2.1 | 1.9 | 2.0 | 1.9 | 1.8 | 1.9 | 1.8 | 1.9 | 2.0 |
| 4. Trucking | 5.6 | 6.0 | 5.9 | 6.1 | 7.1 | 8.2 | 8.6 | 9.3 | 9.6 | 10.2 |
| 5. Intercity bus/ urban transit | 1.8 | 2.1 | 2.4 | 2.6 | 2.7 | 3.0 | 3.4 | 3.7 | 3.8 | 4.3 |
| 6. Taxicabs | 0.4 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.8 | 0.8 |
| 7. Pipelines | 0.7 | 0.8 | 1.1 | 1.3 | 1.4 | 1.5 | 1.6 | 1.9 | 1.9 | 1.8 |
| **8. Total** | **19.6** | **22.3** | **22.8** | **24.2** | **26.4** | **28.5** | **29.8** | **31.7** | **33.1** | **34.5** |
| **II. Transportation services produced on an own account basis — excluding car** | | | | | | | | | | |
| Private trucking | | | | | | | | | | |
| 9. Based on published data | 3.8 | 3.9 | 4.0 | 4.4 | 4.1 | 4.2 | 4.1 | 4.3 | 4.6 | 4.8 |
| 10. Adjustment for incomplete coverage | 3.1 | 3.6 | 3.7 | 4.1 | 4.4 | 4.8 | 5.1 | 5.5 | 6.1 | 6.5 |
| 11. Private marine | 0.3 | 0.4 | 0.3 | 0.4 | 0.6 | 0.5 | 0.3 | 0.4 | 0.4 | 0.3 |
| 12. Pipelines — own account | 0.8 | 1.2 | 1.3 | 1.2 | 1.3 | 1.4 | 1.3 | 1.3 | 1.1 | 1.1 |
| 13. Allowance for private air | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| **14. Total** | **8.4** | **9.4** | **9.8** | **10.5** | **10.8** | **11.4** | **11.3** | **12.1** | **12.8** | **13.3** |

*Table 1(2)-1 (cont'd)*

### RESOURCES DEVOTED TO TRANSPORTATION, 1980–1989
### ($ BILLIONS, CURRENT DOLLARS)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **III. Car — own account** | | | | | | | | | | |
| A. Expenditures on new and used (net) cars | | | | | | | | | | |
| 15. Personal | 8.4 | 9.0 | 7.8 | 9.8 | 12.1 | 15.2 | 16.6 | 17.9 | 19.9 | 20.4 |
| 16. Residual (business and government) | 3.0 | 3.2 | 2.4 | 3.3 | 4.5 | 5.6 | 6.3 | 7.5 | 7.9 | 7.7 |
| 17. Subtotal | 11.4 | 12.2 | 10.2 | 13.2 | 16.6 | 20.8 | 22.9 | 25.5 | 27.8 | 28.2 |
| B. Expenditures on gasoline | | | | | | | | | | |
| 18. Personal | 5.9 | 7.8 | 8.6 | 9.0 | 9.6 | 10.4 | 9.5 | 10.2 | 10.6 | 11.5 |
| 19. Residual (business and government) | 3.0 | 4.1 | 4.2 | 4.2 | 4.2 | 4.0 | 3.4 | 3.6 | 3.5 | 3.5 |
| 20. Subtotal | 8.9 | 11.8 | 12.9 | 13.2 | 13.8 | 14.4 | 13.0 | 13.8 | 14.0 | 15.0 |
| C. Other expenditures on car operation | | | | | | | | | | |
| 21. Personal | 4.8 | 5.5 | 6.0 | 6.5 | 6.8 | 7.3 | 8.4 | 9.8 | 10.9 | 11.6 |
| 22. Residual (business and government) | 2.1 | 2.3 | 2.5 | 2.6 | 2.7 | 2.7 | 3.1 | 3.9 | 4.1 | 4.1 |
| 23. Subtotal | 6.9 | 7.8 | 8.5 | 9.1 | 9.5 | 10.0 | 11.5 | 13.6 | 15.0 | 15.7 |
| **24. Total (17+20+23)** | **27.2** | **31.8** | **31.6** | **35.5** | **39.9** | **45.2** | **47.3** | **52.8** | **56.8** | **58.8** |
| **IV. Government capital and operating expenditures to support transportation** | | | | | | | | | | |
| A. Total transportation expenditures | | | | | | | | | | |
| 25. Federal | 2.4 | 2.1 | 2.6 | 3.0 | 3.5 | 3.3 | 3.4 | 3.5 | 3.5 | 3.4 |
| 26. Provincial/local | 6.6 | 7.4 | 8.4 | 8.2 | 8.1 | 9.1 | 8.9 | 9.2 | 9.4 | 10.8 |
| 27. Road policing and safety | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.8 | 0.9 | 0.9 | 1.0 |
| 28. Subtotal | 9.5 | 10.0 | 11.6 | 11.8 | 12.4 | 13.1 | 13.1 | 13.6 | 13.8 | 15.1 |
| 29. Subsidies to common carriers | 1.3 | 1.7 | 2.0 | 2.1 | 1.8 | 2.0 | 2.2 | 2.4 | 2.5 | 2.7 |
| **30. Total (28–29)** | **8.2** | **8.4** | **9.5** | **9.7** | **10.6** | **11.2** | **10.9** | **11.2** | **11.3** | **12.5** |

## *Table 1(2)-1 (cont'd)*
## *RESOURCES DEVOTED TO TRANSPORTATION, 1980–1989*
## *($ BILLIONS, CURRENT DOLLARS)*

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **V. Deductions to eliminate double counting** | | | | | | | | | | |
| A. Government transportation revenues | | | | | | | | | | |
| 31. Motive fuel taxes | 1.7 | 2.3 | 2.6 | 2.7 | 2.7 | 3.0 | 3.6 | 4.9 | 5.0 | 4.9 |
| 32. Air transportation tax | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.5 |
| 33. Motor vehicle permits | 1.2 | 1.3 | 1.3 | 1.3 | 1.5 | 1.5 | 1.6 | 1.8 | 1.9 | 2.0 |
| 34. Other air revenues | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| 35. Subtotal | 3.3 | 4.0 | 4.3 | 4.5 | 4.7 | 5.2 | 5.9 | 7.5 | 7.9 | 8.0 |
| B. Transport inter-industry requirements and transport margins | | | | | | | | | | |
| 36. Carriers | 2.3 | 2.5 | 2.4 | 2.6 | 3.1 | 3.4 | 3.5 | 3.7 | 3.9 | 4.1 |
| 37. Business — own account | 1.1 | 1.0 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.5 | 1.5 | 1.5 |
| 38. Consumers — own account | 1.2 | 1.2 | 1.1 | 1.2 | 1.4 | 1.7 | 1.9 | 2.0 | 2.2 | 2.3 |
| 39. Subtotal | 4.6 | 4.7 | 4.4 | 4.8 | 5.6 | 6.3 | 6.8 | 7.2 | 7.6 | 8.0 |
| **40. Total deductions (35+39)** | **7.9** | **8.7** | **8.7** | **9.3** | **10.3** | **11.5** | **12.7** | **14.7** | **15.5** | **15.9** |
| **VI. Total resources devoted to transportation** | | | | | | | | | | |
| **41. Grand total (8+14+24+30–40)** | **55.6** | **63.2** | **65.0** | **70.5** | **77.4** | **84.7** | **86.6** | **93.1** | **98.4** | **103.1** |
| 42. GDP at market prices | 309.9 | 356.0 | 374.4 | 405.7 | 444.7 | 478.0 | 505.7 | 551.6 | 605.9 | 649.9 |

**Notes and Sources to Table 1(2)-1**

***I. Transportation services produced by businesses for sale (carrier revenues including government subsidies)***

1. ***Air: 1980–1989:*** **Statistics Canada, *Air Carrier Financial Statements/Canadian Civil Aviation*, Catalogue No. 51-206, Table 1 (1980–1981), Table 3 (1982–1987), and Table 3.1 (1988–1989).**

2. ***Rail: 1980–1987:*** **Statistics Canada, *Rail in Canada 1987*, Catalogue No. 52-216, November 1989, Figure 1.2, page 28; *1988–1989:* Statistics Canada, *Rail in Canada 1989*, Catalogue No. 52-216, October 1991, Figure 2.1, page 26.**

3. *Marine: 1980–1989:* Statistics Canada, *Shipping in Canada,* Catalogue No. 54-205, Table 2, line 14 (1980–1984), Figure 8.5 (1985), and Figure 8.3 (1986–1989).

4. *Trucking: 1980–1983:* Statistics Canada, *Trucking in Canada,* Catalogue No. 53-222, Table 7, line 4 (Freight Movers), and Text Table XIV, line 8 (1980–1981), and Text Table I, line 8 (1982–1983) (Household Goods Movers); *1984–1989:* Statistics Canada, *Trucking in Canada,* Catalogue No. 53-222, Figure 2.8, line 4 (1984–1988), Figure 2.26, line 4 (1989).

5 *Intercity bus/urban transit: 1980–1989:* Statistics Canada, *Passenger Bus and Urban Statistics,* Catalogue No. 53-215.

6. *Taxicabs: 1980–1987:* Statistics Canada, *The Input-Output Structure of the Canadian Economy 1987,* Catalogue No. 15-201, February 1991, Table A; *1988:* Statistics Canada, *The Input-Output Structure of the Canadian Economy 1988,* Catalogue No. 15-201, January 1992, Table A.
Note: The figure shown is for GDP in current dollars at factor cost rather than total revenues. However, most purchased inputs for the taxi industry are in principle included in component III.

7. *Pipelines: 1980–1987:* Statistics Canada, *Corporation Financial Statistics,* Catalogue No. 61-207, Table 2B; 1988–1989: Estimates based on unpublished material from Statistics Canada.

*II. Transportation services produced on an own account basis — excluding car*

9. *Private trucking* — based on published data: *1982–1983:* Unpublished data from Statistics Canada; *1984–1988:* Statistics Canada, *Trucking in Canada,* Catalogue No. 53-222.
Data extrapolated to 1989 (given reduced coverage of 1989 published data) and to 1980 and 1981.

11. *Private marine: 1980–1989:* Statistics Canada, *Shipping in Canada,* Catalogue No. 54-205, Table 2, line 14 (1980–1984), Figure 8.5 (1985), and Figure 8.3 (1986–1989).

12. *Pipelines — own account: 1980–1987:* Statistics Canada, *Corporation Financial Statistics,* Catalogue No. 61-207, Table 2B; *1988–1989:* Estimates based on unpublished material from Statistics Canada.
Estimate is based on difference between value of sales of products and value of raw materials purchases.

13. *Allowance for private air:* See text — estimate for United States private air is from F. Smith, *Transportation in America* (Eno Foundation, Westport, Conn., May 1990), p. 6.

*III. Car — own account*

*A. Expenditures on new and used (net) motor vehicles*

15. *Personal: 1980–1989:* Statistics Canada, *National Income and Expenditure Accounts, Annual Estimates, 1980–1991,* Catalogue No. 13-201, August 1992, Table 52, pp. 66–67.

16. *Residual:* The difference between 17 and 15.

**17.** ***Subtotal: 1980–1989:*** **Statistics Canada, *New Motor Vehicle Sales,* Catalogue No. 63-007, Vol. 63, No. 10, August 1992, Table 9.**
**Adjusted to include an allowance for dealer margins on used cars which would be included in 15 — assumed to be 10% of line 15.**

***B. Expenditures on gasoline***

**18.** ***Personal:*** **See item 15.**

**19.** ***Residual:*** **The difference between 20 and 18.**

**20.** ***Subtotal:*** **Quantities of gasoline sold — 1980–1989: Statistics Canada, *Road Motor Vehicles, Fuel Sales,* Catalogue No. 53-218, Table 1.**
**Average fuel prices — *1980–1989:* Unpublished data from Energy, Mines and Resources. The price of regular unleaded gasoline was used to estimate the total value of gasoline sold.**
**Gasoline for car use is assumed to be 95% of total road gasoline sales less an allowance for share of light truck use not related to passenger transportation (20% of estimated light truck use).**

***C. Other expenditures on car operation***

**21.** ***Personal:*** **See item 15.**

**22.** ***Residual:*** **The ratio of residual to personal spending for vehicles and fuel combined multiplied by line 21.**

***IV. Government capital and operating expenditures to support transportation***

**25.** ***Federal government expenditures: 1980–1986:*** **Statistics Canada, *Federal Government Finance, Revenue and Expenditure, Assets and Liabilities,* Catalogue No. 68-211, Table 2; *1987–1989:* Unpublished data from Public Institutions Division, Statistics Canada.**

**26.** ***Provincial/local expenditures:***
**Residual derived from total consolidated government expenditures on transportation less federal government expenditures. (Thus, the provincial/local expenditures figure is a consolidation of provincial/local expenditures less transfers from federal government tied to transportation programs.)**
**Total Consolidated Government Expenditures — *1980–1982:* Statistics Canada, *Consolidated Government Finance,* Catalogue No. 68-202, Table 2; *1983–1989:* Unpublished data from Public Institutions Division, Statistics Canada.**

**27.** ***Road policing and safety:***
**Royal Commission staff estimates — road policing estimate (see section 5.1.4 of Notes to Chapter 3 in this Volume) approximately doubled to allow for other related spending by non-transport departments on motor vehicle registrations, control and safety.**

***V. Deductions to eliminate double counting***

***A. Consolidated government transportation revenues***

*31.* ***Motive fuel taxes: 1980–1989:*** **Statistics Canada, P*ublic Finance Historical Data, 1965/66–1991/92,* Catalogue No. 68-512, March 1992, Table H1 (Federal) and H3 (Provincial).**

**With provincial revenues adjusted approximately to remove revenues that would have been generated if standard provincial sales tax rates were applied to motive fuels (since such fuels are generally exempt from provincial retail sales tax).**

*32.* ***Air transportation tax: 1980–1983:*** **Statistics Canada, *Consolidated Government Finance,* Catalogue No. 68-202, Table 1 and unpublished material from Public Institutions Division, Statistics Canada; *1984–1989:* Supply and Services Canada, *Public Accounts,* Volume 2, Transport Canada section.**

*33.* ***Motor vehicle permits: 1980–1985:*** **Statistics Canada, *Consolidated Government Finance,* Catalogue No. 68-202, Table 1 and unpublished material from Statistics Canada; *1986–1990:* Statistics Canada, *National Income and Expenditure Accounts, Annual Estimates, 1980–1991,* Catalogue No. 13-201, August 1992, Table 44, line 15, and Table 45, line 2.**

**34. Other air revenues: 1980–1989: Supply and Services Canada, Public Accounts, Volume 2, Transport Canada section.**

***B. Transport inter-industry requirements and transport margins***

***1980–1989:*** **Statistics Canada, *The Input-Output Structure of the Canadian Economy,* Catalogue No. 15-201.**

*36.* ***Carriers:*** **Based on the ratio of "transportation and storage" and of "transportation margins" used by transport industry to the total output of the transport industry (use Matrix, aggregation "M").**

*37. and 38.* ***Business and consumer — own account:*** **Based on the ratio of transport margins to total values of final sales for "motor vehicles and parts" and "motor fuels and lubricants" (final demand matrix, aggregation "M"), multiplied by 2 as a rough allowance for own account transportation inputs (not counted in transportation margins) into these commodities.**

*42.* ***GDP at market prices: 1980–1989:*** **Department of Finance, *Economic Reference Tables,* August 1992, p. 5.**

## I. Transportation services produced by business for sale (carrier revenues including direct government subsidies)

The table shows revenues for the major categories of carriers. Sales revenues are used as a measure of total resources devoted to producing these transportation services.

Revenues of travel and ticket agents, and of car and truck rental operations, might also be considered for inclusion in a broad measure of transportation. The data on carrier revenues, however, are generally reported before deducting commission charges of agents; thus a considerable portion of agent commissions is already included in carrier revenues. Much of the revenues of car and truck rental operations, which totalled about $3 billion in 1989, will in principle be captured in the estimate of resources devoted to private trucking and car use in components II and III.

### II. Transportation services produced by businesses for their own account — excluding business use of cars

Businesses and governments devote substantial "in-house" resources to transportation in addition to being major customers for the services of transportation carriers (the latter purchases are included in component I).

These in-house transportation activities are divided into:

- private trucking;
    - based on published data; and
    - adjustment for incomplete coverage
- own account marine transport;
- own account pipeline use; and
- allowance for business aircraft.

As set out in the note on sources to Table 1(2)-1, some data are available for Canada on the first three categories of own account transportation activity. The reported data seem very likely, however, to underestimate substantially the total resources devoted to private trucking. An allowance for incomplete coverage of private trucking is thus added, which is equal to 1% of GDP for all years. This adds an amount somewhat higher than the published data for expenditures on private trucking in the later years covered by the table; it is believed to be a conservative allowance. Road diesel sales not accounted for in the published statistics on diesel fuel use by for-hire truck, private truck, and bus are roughly equal to the amount that is accounted for by such sales, and are more than twice the level of reported sales to private trucking alone. This suggests that private trucking activity not covered in the official statistics is likely to be larger than private trucking activity which is covered.

There are no comprehensive data on business use of company-owned aircraft. Aviation gasoline sales data coupled with data on fuel consumption by carriers, suggest a substantial level of aviation activity by other than carriers. The allowance made is .1% of GDP, a level somewhat lower than estimates for the United States.

Data on business and government use of cars are not readily available. This category has been dealt with on the basis of overall data on cars, and is included as part of component III.

### III. Own account car expenditures

Travel by car is the predominant means of urban and intercity travel in Canada. (As is the practice throughout this report, car refers to both passenger automobiles and light trucks used for passenger transportation purposes.) Data are available for total consumer expenditure on car purchase and operation including maintenance and repairs, fuel, insurance and licence fees. Data are also available which permit estimates of the total value of new car sales, and of gasoline sales.

The residuals, when one deducts the value of car sales (including net sales of used cars) to consumers from the total value of car sales and deducts gasoline sales for car use to consumers from total gasoline sales for car use, provide estimates of business (including car rental operations) and government expenditures on car purchase and fuel. The "residual" for other car operating expenditures is calculated by applying the average ratio of the residual to consumer expenditure for car purchases and fuel purchases, to consumer expenditures for other car operating costs.

The estimates in the table count investment in new cars in the year of purchase, rather than amortizing the price of the car over its life and include an allowance for cost of capital. The latter approach is followed in deriving the cost estimates of car use in Chapter 3 of Volume 1. The two approaches, however, can be expected to produce quite similar results on average although they could diverge substantially in years of cyclically high or low car sales.

No allowance is made in these estimates (or in the cost analysis in Chapter 3 of Volume 1) for any cost of the driver's time.

### IV. Government capital and operating expenditures to support transportation

Governments use resources to build and maintain transportation infrastructure including roads and airports, to provide air and marine navigation and traffic control services, and to control and police road traffic.

For purposes of the table, an estimate of total government investment and operating expenditures related to the provision of transportation is required. This estimate is derived using data on total recorded government spending on transportation, plus an estimate of spending on road policing and related government enforcement and safety activities occurring outside of transport departments. Direct government subsidies to transportation carriers are then subtracted from total government expenditure on transportation. (The subsidies have been included in the value of sales of carrier services in component I.) Component IV does not include expenditures by government to purchase or provide transportation for use by government; such expenditures should be covered in components I and III.

Intergovernmental transfers relating to transportation programs are excluded to avoid double counting. The treatment of government transportation investment follows the practice of public accounts, that is, investment is recorded in the year the expenditure is made rather than amortized over the life of the asset as in the cost estimates of Chapter 3 of Volume 1.

The estimates of expenditures in components I to IV involve some double counting that should be eliminated in order to calculate total resources devoted to transportation.

### V. Adjustments to eliminate double counting

The charges, fees and special taxes that governments levy on users of some government-provided transportation facilities, and that cover some of the costs of government transportation services (IV), are included in the prices paid for transportation in components I, II and III. Thus, to add total expenditures on transportation in components I, II and III to government transportation expenditures in component IV, would result in double counting. The table subtracts charges, fees and special taxes that governments levy for use of transportation facilities. These are the infrastructure charges and the special transportation taxes and fees discussed in Chapter 3 of Volume 1, and in Notes to Chapter 3 in this Volume. As in Chapter 3, the amounts of provincial gasoline and other motive fuel taxes in excess of standard rates of general provincial sales taxes are considered to be equivalent to user charges for government-provided transportation facilities for purposes of this table.

A second source of double counting arises because the expenditures in components I to IV include, directly and indirectly, some inputs that are already counted in the sales revenues of common carriers (I). For example, the cost of common carrier services (I) and of own account (II and III) activity includes the cost of gasoline and other fuels, some part of which is the cost of transporting the fuel to where it is sold. Such transportation costs for fuel will already be reflected in (freight) carrier sales revenues. The table thus includes an approximate adjustment, based on Statistics Canada Input-Output Accounts data, to eliminate inter-transportation-industry transportation requirements and transportation margins.

Estimated total resources devoted to transportation (VI) are then calculated as the sum of components I through IV, less adjustments to eliminate double counting (V).

Table 1(2)-2 expresses the dollar estimates from Table 1(2)-1 as percentages of GDP. The 15.9% shown for 1989 in the final line of the table is the basis for the statement in Chapter 1 of Volume 1 that resources equal to about 16% of GDP were devoted to all forms of transportation in that year.

The estimation procedures are viewed as adequate to support the conclusion that a substantial portion of the economy's resources is devoted to providing transportation. For several types of carrier, however, the data used in Table 1(2)-1 and Table 1(2)-2 do not cover small operators and thus tend to under-estimate total transportation provided in the sector. The allowances for lack of coverage of much of private trucking, and of own account aircraft operation, are probably on the low side. The approach would need to be refined before the estimates could be used to draw strong conclusions as to changes in the share of resources devoted to transportation over time, or be used to make precise international comparisons.

*Table 1(2)-2*

*Resources Devoted to Transportation as a Percentage of GDP at Market Prices, 1980–1989 (Percent)*

| | **1980** | **1981** | **1982** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** |
|---|---|---|---|---|---|---|---|---|---|---|
| **I. Transportation services produced by businesses for sale (carrier revenues including government payments to carriers)** | | | | | | | | | | |
| 1. Air | 1.3 | 1.3 | 1.2 | 1.2 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| 2. Rail | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 | 1.1 |
| 3. Marine | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 |
| 4. Trucking | 1.8 | 1.7 | 1.6 | 1.5 | 1.6 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 |
| 5. Intercity bus/ urban transit | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.6 | 0.7 |
| 6. Taxicabs | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 7. Pipelines | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| **8. Total** | **6.3** | **6.3** | **6.1** | **6.0** | **5.9** | **6.0** | **5.9** | **5.7** | **5.5** | **5.3** |

*Table 1(2)-2 (cont'd)*

## RESOURCES DEVOTED TO TRANSPORTATION AS A PERCENTAGE OF GDP AT MARKET PRICES, 1980–1989 (PERCENT)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **II. Transportation services produced on an own account basis — excluding car** | | | | | | | | | | |
| Private trucking | | | | | | | | | | |
| 9. Based on published data | 1.2 | 1.1 | 1.1 | 1.1 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.7 |
| 10. Adjustment for incomplete coverage | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 11. Private marine | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| 12. Pipelines — own account | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| 13. Allowance for private air | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **14. Total** | **2.7** | **2.7** | **2.6** | **2.6** | **2.4** | **2.4** | **2.2** | **2.2** | **2.1** | **2.0** |
| **III. Car — own account** | | | | | | | | | | |
| A. Expenditures on new and used (net) cars | | | | | | | | | | |
| 15. Personal | 2.7 | 2.5 | 2.1 | 2.4 | 2.7 | 3.2 | 3.3 | 3.3 | 3.3 | 3.1 |
| 16. Residual (business and government) | 1.0 | 0.9 | 0.7 | 0.8 | 1.0 | 1.2 | 1.2 | 1.4 | 1.3 | 1.2 |
| 17. Subtotal | 3.7 | 3.4 | 2.7 | 3.2 | 3.7 | 4.3 | 4.5 | 4.6 | 4.6 | 4.3 |
| B. Expenditures on gasoline | | | | | | | | | | |
| 18. Personal | 1.9 | 2.2 | 2.3 | 2.2 | 2.2 | 2.2 | 1.9 | 1.8 | 1.7 | 1.8 |
| 19. Residual (business and government) | 1.0 | 1.1 | 1.1 | 1.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6 | 0.5 |
| 20. Subtotal | 2.9 | 3.3 | 3.4 | 3.3 | 3.1 | 3.0 | 2.6 | 2.5 | 2.3 | 2.3 |
| C. Other expenditures on car operation | | | | | | | | | | |
| 21. Personal | 1.6 | 1.5 | 1.6 | 1.6 | 1.5 | 1.5 | 1.7 | 1.8 | 1.8 | 1.8 |
| 22. Residual (business and government) | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.6 |
| 23. Subtotal | 2.2 | 2.2 | 2.3 | 2.2 | 2.1 | 2.1 | 2.3 | 2.5 | 2.5 | 2.4 |
| **24. Total (17+20+23)** | **8.8** | **8.9** | **8.4** | **8.7** | **9.0** | **9.5** | **9.4** | **9.6** | **9.4** | **9.0** |

*Table 1(2)-2 (cont'd)*

## RESOURCES DEVOTED TO TRANSPORTATION AS A PERCENTAGE OF GDP AT MARKET PRICES, 1980–1989 (PERCENT)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **IV. Government capital and operating expenditures to support transportation** | | | | | | | | | | |
| A. Total transportation expenditures | | | | | | | | | | |
| 25. Federal | 0.8 | 0.6 | 0.7 | 0.7 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 | 0.5 |
| 26. Provincial/local | 2.1 | 2.1 | 2.2 | 2.0 | 1.8 | 1.9 | 1.8 | 1.7 | 1.5 | 1.7 |
| 27. Road policing and safety | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 28. Subtotal | 3.1 | 2.8 | 3.1 | 2.9 | 2.8 | 2.7 | 2.6 | 2.5 | 2.3 | 2.3 |
| 29. Subsidies to common carriers | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| **30. Total (28–29)** | **2.6** | **2.3** | **2.6** | **2.4** | **2.4** | **2.3** | **2.2** | **2.0** | **1.9** | **1.9** |
| **V. Deductions to eliminate double counting** | | | | | | | | | | |
| A. Government transportation revenues | | | | | | | | | | |
| 31. Motive fuel taxes | 0.6 | 0.6 | 0.7 | 0.7 | 0.6 | 0.6 | 0.7 | 0.9 | 0.8 | 0.8 |
| 32. Air transportation tax | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 33. Motor vehicle permits | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 34. Other air revenues | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 35. Subtotal | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.4 | 1.3 | 1.2 |
| B. Transport inter-industry requirements and transport margins | | | | | | | | | | |
| 36. Carriers | 0.7 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 |
| 37. Business — own account | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| 38. Consumers — own account | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 39. Subtotal | 1.5 | 1.3 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 |
| **40. Total deductions (35+39)** | **2.5** | **2.4** | **2.3** | **2.3** | **2.3** | **2.4** | **2.5** | **2.7** | **2.6** | **2.4** |
| **VI. Total resources devoted to transportation** | | | | | | | | | | |
| **41. Grand total (8+14+24+30–40)** | **17.9** | **17.8** | **17.4** | **17.4** | **17.4** | **17.7** | **17.1** | **16.9** | **16.2** | **15.9** |

## 2. COMPARISON WITH RESOURCES DEVOTED TO HEALTH CARE

The discussion of resources devoted to transportation in Chapter 1 of Volume 1 also notes that resources equal to 9% of GDP were devoted to health care in Canada. Health and Welfare Canada has estimated that total public and private expenditures, on capital and operating costs of hospitals and other health care institutions, on physicians' and other health professionals' services, and on pharmaceuticals, equalled 8.7% of GDP in 1989 and 9.2% in 1990 (Policy, Planning and Information Branch, "Canadian Health Care Expenditures" by source of funds and by category, unpublished tables, March 1992). These appear to be conceptually comparable with the estimates of total resources devoted to transportation in Tables 1(2)-1 and 1(2)-2. Virtually all health care expenditures, however, would be classified as final expenditures in the National Income and Expenditure Accounts, unlike the case for transportation where, especially for freight transportation, a substantial portion would be classified as intermediate (an input into the production of other goods and services).

## 3. VALUE ADDED BY TRANSPORTATION CARRIERS

As noted, the estimate of total resources devoted to transportation presented in Table 1(2)-1 is a broad measure of the size of transportation in the economy. A very different measure, to which reference is more frequently made, is the "share of transportation industries in GDP." "Transportation industries," as defined by Statistics Canada, are basically the transportation carriers plus industries producing certain related services. The GDP of these industries is the value added by firms in the industries; that is, the value of their sales less the value of goods and services purchased from firms in other industries. This essentially represents the value of their wages, depreciation, interest and profits.

Table 1(2)-3 shows Statistics Canada data on GDP (at factor cost in constant 1986 dollars) in the transportation sector as percentages of total GDP (at factor cost in 1986 dollars). The percentage for total transportation, 4.8% in 1989, is much less than the Table 1(2)-2 estimate for total resources devoted to transportation. The difference reflects both the fact that the latter estimate included own account transportation activity by businesses, governments and, most importantly, consumers in the form of car travel, and the fact that it included total resources used including resources (for example, fuel) purchased from firms in other industries, as well as resources provided directly by transportation firms.

*Table 1(2)-3*

*GROSS DOMESTIC PRODUCT AT FACTOR COST FOR TRANSPORTATION INDUSTRIES, 1980–1989*

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **I. GDP at factor cost (billions of dollars at 1986 prices)** | | | | | | | | | | |
| Air | 2.3 | 2.2 | 2.1 | 2.3 | 2.6 | 2.8 | 2.9 | 3.0 | 3.3 | 3.3 |
| Rail | 3.4 | 3.4 | 2.7 | 2.9 | 3.7 | 3.7 | 3.9 | 4.1 | 4.3 | 4.1 |
| Water | 1.2 | 1.1 | 1.1 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.5 | 1.5 |
| Truck | 4.2 | 4.3 | 4.2 | 4.5 | 5.3 | 5.3 | 5.4 | 6.0 | 6.4 | 6.6 |
| Urban transit | 1.7 | 1.8 | 1.7 | 1.7 | 1.5 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 |
| Interurban bus | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Other transport industries[a] | 1.7 | 1.6 | 1.5 | 1.8 | 2.1 | 2.2 | 2.2 | 2.3 | 2.3 | 2.3 |
| Total business sector industries | 14.6 | 14.5 | 13.6 | 14.8 | 16.7 | 17.0 | 17.5 | 18.4 | 19.5 | 19.5 |
| Pipeline transport | 2.0 | 1.9 | 1.9 | 1.9 | 2.1 | 2.1 | 2.1 | 2.4 | 2.8 | 3.0 |
| Non-business sector industries[b] | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 2.1 | 1.9 | 2.0 | 2.0 | 2.0 |
| Grand total transport | 18.8 | 18.5 | 17.5 | 18.6 | 20.7 | 21.2 | 21.6 | 22.8 | 24.3 | 24.5 |
| **Total economy** | **382.0** | **397.1** | **382.6** | **395.0** | **418.7** | **438.5** | **451.8** | **470.9** | **491.0** | **506.1** |

*Table 1(2)-3 (cont'd)*

GROSS DOMESTIC PRODUCT AT FACTOR COST FOR TRANSPORTATION INDUSTRIES, 1980–1989

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **II. Percentage shares of GDP for the total economy** | | | | | | | | | | |
| Air | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 |
| Rail | 0.9 | 0.8 | 0.7 | 0.7 | 0.9 | 0.8 | 0.9 | 0.9 | 0.9 | 0.8 |
| Water | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Truck | 1.1 | 1.1 | 1.1 | 1.1 | 1.3 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 |
| Urban transit | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 |
| Interurban bus | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other transport industries[a] | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Total business sector industries | 3.8 | 3.7 | 3.6 | 3.7 | 4.0 | 3.9 | 3.9 | 3.9 | 4.0 | 3.9 |
| Pipeline transport | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 |
| Non-business sector industries[b] | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 |
| **Grand total transport** | **4.9** | **4.7** | **4.6** | **4.7** | **4.9** | **4.8** | **4.8** | **4.8** | **4.9** | **4.8** |

**Source: Statistics Canada, *CANSIM*, matrix 4671.**

**a. Other transport industries include taxicab, other transportation, and highway and bridge maintenance industries. This component was calculated residually given the preceding components and the total for business sector industries.**

**b. Non-business sector industries include establishments, primarily government-owned, which provide services used by transportation carriers, including airport and port operation, and — where carried out by government departments — highway, street and bridge maintenance.**

**Note: Components may not add exactly to totals due to rounding.**

## 4. ESTIMATE OF RESOURCES DEVOTED TO INTERCITY PASSENGER TRANSPORTATION

Part A of Table 1(2)-4 shows estimates of the intercity passenger transportation share of the total carrier revenues in component I of Table 1(2)-1, and repeats from Table 1(2)-1 the allowance for use of company-owned aircraft — all of which is assumed to be for intercity passenger purposes. Also shown are two estimates of the intercity share of car use. These shares are intended to correspond to a broad definition of intercity car travel — (a) — all car travel on provincial highways, and a narrower definition — (b) — use of highways for trips extending beyond a single metropolitan or urban area.

The share corresponding to the broad definition (a) is defined using the ratio of estimated car vehicle-kilometres on provincial highways to total car vehicle-kilometres from Table 2(2)-A1, in the Annex to Notes to Chapter 2 in this volume. This ratio — 54.2% — is applied to total own account car expenditures (line 24) from Table 1(2)-1. The estimate for the narrower definition (b) is simply two thirds of the broad estimate — the same ratio as used in Notes to Chapter 2 in estimating car passenger-kilometres corresponding to the narrower definition of intercity travel.

Finally, Table 1(2)-4 includes an approximate allowance for the intercity passenger travel share of government transportation expenditures. For the purposes of this table, the estimate of relevant government transportation expenditures is defined using the ratio of non-government expenditures on intercity passenger travel (the sum of lines 5, 6 and 7 in Table 1(2)-4, or of lines 5, 6 and the value corresponding to line 7 for narrow intercity car use) to total non-government expenditures on transportation (the sum of lines 8, 14 and 24 in Table 1(2)-1). This ratio is applied to government capital and operating expenditures to support transportation net of government transportation charges (line 30 less line 35 from Table 1(2)-1).

A more painstaking, although still approximate, allocation of total government transportation expenditures to intercity passenger transportation was used to estimate government infrastructure costs for purposes of the modal cost comparisons in Chapter 3 of Volume 1 (further discussed in Notes to Chapter 3 in this Volume). However, to estimate an approximate overall share of resources devoted to intercity passenger transportation, the above procedure was considered adequate.

*Table 1(2)-4*

## RESOURCES DEVOTED TO INTERCITY PASSENGER TRANSPORTATION, 1980–1989

| | **1980** | **1981** | **1982** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** |
|---|---|---|---|---|---|---|---|---|---|---|
| A. $ billions, current dollars | | | | | | | | | | |
| **Carrier intercity passenger services (including government payments to carriers)** | | | | | | | | | | |
| 1. Air | 3.2 | 3.8 | 3.9 | 3.8 | 4.2 | 4.6 | 5.0 | 5.3 | 6.0 | 6.6 |
| 2. Rail | 0.6 | 0.8 | 0.7 | 0.8 | 0.7 | 0.9 | 0.8 | 0.8 | 0.9 | 0.8 |
| 3. Ferries | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 4. Intercity bus | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| **5. Total** | **4.3** | **5.1** | **5.1** | **5.1** | **5.4** | **6.0** | **6.3** | **6.7** | **7.5** | **8.0** |
| 6. Allowance for private air | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| **Own account intercity car** | | | | | | | | | | |
| 7. Broad measure (a) | 14.7 | 17.3 | 17.1 | 19.2 | 21.6 | 24.5 | 25.7 | 28.6 | 30.8 | 31.9 |
| **Government capital and operating expenditures to support intercity passenger transportation net of transportation taxes/charges** | | | | | | | | | | |
| 8. Corresponding to broad measure of intercity car (a) | 1.7 | 1.6 | 1.9 | 1.8 | 2.1 | 2.2 | 1.8 | 1.4 | 1.3 | 1.7 |
| **Total expenditures in intercity passenger transportation** | | | | | | | | | | |
| 9. Carrier, air, plus broad intercity car (a) | 21.1 | 24.2 | 24.5 | 26.6 | 29.5 | 33.2 | 34.3 | 37.2 | 40.1 | 42.2 |
| 10. Carrier, air, plus narrow intercity car (b) | 15.6 | 18.0 | 18.1 | 19.6 | 21.6 | 24.3 | 25.1 | 27.2 | 29.5 | 31.0 |
| 11. GDP at market prices | 309.9 | 356.0 | 374.4 | 405.7 | 444.7 | 478.0 | 505.7 | 551.6 | 605.9 | 649.9 |

*Table 1(2)-4 (cont'd)*

## RESOURCES DEVOTED TO INTERCITY PASSENGER TRANSPORTATION, 1980–1989

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| B. Percentages of GDP at market prices | | | | | | | | | | |
| **Carrier intercity passenger services (including government payments to carriers)** | | | | | | | | | | |
| 1. Air | 1.0 | 1.1 | 1.0 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2. Rail | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| 3. Ferries | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 4. Intercity bus | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| **5. Total** | **1.4** | **1.4** | **1.4** | **1.3** | **1.2** | **1.3** | **1.2** | **1.2** | **1.2** | **1.2** |
| 6. Allowance for private air | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **Own account intercity car** | | | | | | | | | | |
| 7. Broad measure (a) | 4.8 | 4.8 | 4.6 | 4.7 | 4.9 | 5.1 | 5.1 | 5.2 | 5.1 | 4.9 |
| **Government capital and operating expenditures to support intercity passenger transportation net of transportation taxes/charges** | | | | | | | | | | |
| 8. Corresponding to broad measure of intercity car (a) | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.2 | 0.2 | 0.3 |
| **Total expenditures on intercity passenger transportation** | | | | | | | | | | |
| 9. Carrier, air, plus broad intercity car (a) | 6.8 | 6.8 | 6.5 | 6.6 | 6.6 | 6.9 | 6.8 | 6.7 | 6.6 | 6.5 |
| 10. Carrier, air, plus narrow intercity car (b) | 5.0 | 5.0 | 4.8 | 4.8 | 4.9 | 5.1 | 5.0 | 4.9 | 4.9 | 4.8 |

***Notes and Sources to Table 1(2)-4***

***Carrier intercity passenger services plus car rental***

1. **Air:** ***1980–1987:*** **Unpublished data from Statistics Canada;** ***1988–1989:*** **Statistics Canada,** ***Canadian Civil Aviation,*** **Catalogue No. 51-206, Table 3.1.**

2. **Rail:** ***1980–1981:*** **Statistics Canada,** ***Railway Transport: Part II, Financial Statistics,*** **Catalogue No. 52-208, Table 2;** ***1982–1986:*** **Statistics Canada,** ***Railway Transport in Canada: General Statistics,*** **Catalogue No. 52-215, Table 2;** ***1987–1989:*** **Unpublished data from Statistics Canada.**
   **Passenger revenues of VIA Rail and other intercity rail carriers plus VIA Rail operating subsidy from above sources. Adjusted to include government capital grants to VIA Rail, and to assume that ratio of subsidy (including capital grants) for other intercity passenger operations to passenger revenues is the same as for VIA Rail.**

3. ***Ferries: 1980–1989:*** **Unpublished material from Statistics Canada, and carrier annual reports.**
**Revenues from transportation of passengers and passenger vehicles, plus a pro rata share of subsidies.**

4. ***Intercity Bus:*** **Where possible, intercity revenues from all sources, and not just intercity bus establishments, have been collected. Intercity data are found in the operating and income accounts of the four types of bus establishment (i.e. Intercity, Urban, School Bus, Other) in Catalogue No. 53-215 from 1980–1989.**

6. ***Allowance for private air:*** **See text.**

7. ***Own account intercity car:*** **54.2% of line 24 from Table 1(2)-1. See text.**

***Government capital and operating expenditures to support intercity passenger transportation net of transportation taxes/charges***

**Net government expenditures (i.e. line 30 to line 35 of Table 1(2)-1) times the ratio of intercity private expenditures from Table 1(2)-4 to total private expenditures from Table 1(2)-1. See text.**

Part B of Table 1(2)-4 shows the Part A dollar estimates expressed as percentages of GDP. The 1989 shares, rounded, are 5% for the narrower definition of intercity passenger transportation (b) and 7% for the broad definition (a). This is the basis for the percentages in Chapter 1.

An alternative broad estimate of total costs of domestic intercity passenger transportation may be obtained in Table 3-1(b) in Chapter 3. For 1991, this estimate — $43 billion — is 6.4% of GDP. The basis for this alternative estimate differs in a number of respects from that for the estimate in Table 1(2)-4. The alternative includes an estimate of environmental costs associated with intercity passenger transportation, but excludes the costs of international air travel. The alternative uses an annual stream of costs for capital used in transportation by consumers and governments, rather than expenditures on new capital in the year in question.

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# INTRODUCTION

In describing the current situation of Canadian domestic intercity passenger transportation, and in briefly putting this situation in historical and international perspective, the text, charts and tables in Chapter 2 of Volume 1 present estimates for a number of aspects of passenger transportation, particularly when comparing the roles of the different means of transportation. In many cases, it is unfortunately not a question of simply reproducing data from official sources. Rather, Royal Commission staff have developed estimates for various aspects of passenger travel from a variety of sources. Development of the estimates often involves making assumptions that are based in part on judgement rather than solid evidence, and may involve a substantial element of approximation. The sections of these Notes to Chapter 2 are intended to set out the bases for the estimates used in Chapter 2, to report the estimates in fuller detail in a number of the cases, and to provide some additional discussion of conclusions to be drawn from the estimates.

Section 1 — Measures of the Shares of Different Means of Transportation in "Intercity Travel" — deals with the estimates of the current (1990) levels of Canadian domestic intercity passenger transportation provided by car, air, bus, train and ferry. The section refers briefly to charter/tour/cruise travel by bus and ship, which are not included in the basic estimates. Annex 1, at the end of these Notes to Chapter 2, provides a fuller explanation and reporting of estimates of total travel and total highway travel, by car.

Section 2 — Estimates of Domestic Intercity Passenger Transportation Modal Shares, 1930–1990 — explains the basis for, and comments on, the historical estimates of passenger-kilometres of domestic intercity travel by car, air, bus and rail for the period from 1930 to 1990.

Section 3 — International Comparisons of Modal Shares in Passenger Transportation — explains the basis for and comments on comparative estimates of distance travelled by car, airplane, bus and train for Canada, the United States, Japan, France, West Germany and the

United Kingdom. These estimates are for total domestic travel, not just domestic intercity travel, as reasonably comparable international information is only available for total domestic travel.

Sections 2 and 3 do not include travel by ferry. While it can be an important link in intercity travel, it generally accounts for only a fraction of 1% of total intercity distance travelled (passenger-kilometres).

Section 4 — Importance of Long and Short Trips in Domestic Intercity Travel — like Section 1, this section deals with current Canadian domestic intercity passenger transportation. It briefly presents some further information on the relative importance in total domestic travel of trips of different lengths.

## 1. MEASURES OF THE SHARES OF DIFFERENT MEANS OF TRANSPORTATION IN "INTERCITY TRAVEL"

Chapter 2 states that Canadians took over 150 million intercity trips in 1990, of which 134 million were in Canada. The chapter mentions the shares of trips and of total distance travelled for which the different means of passenger transportation account. This section provides a more detailed discussion of data on domestic intercity travel and describes the development of estimates of some aspects of intercity travel for which direct data are not available.

Information on the amount of intercity travel by the different means of passenger transportation helps provide a general understanding of the relative roles of the different means, of changes in these roles over time, and of differences across countries in the roles played by the different means. As is often the case with general descriptive statistics, however, a number of somewhat arbitrary choices have to be made regarding the basis on which to assemble the data. It is not always possible to find a single basis that is fully appropriate for the different purposes for which the statistics may be used. As well, basic data on some aspects of intercity travel, especially travel by car, are scarce. While estimates of total travel by each means are provided, in some cases the estimates are no more than informed guesses. They should be viewed as providing an indication of the broad picture, not as precise measures.

"Intercity" travel may be **defined** either in terms of characteristics of the trip, typically trips in excess of a specified length, or in terms of the means of travel used — air, train (or train other than specified commuter trains), intercity bus (as opposed to urban and suburban transit), specified types of ferries, and car travel involving specified classes of roads. The amount of intercity travel by any means of transportation can be **measured** in terms of number of trips, in terms of distance travelled (for example, passenger-kilometres), or conceivably in terms of total spending on travel by the means. With respect to both the definitions and the measures, it is often difficult to find an approach that treats the different means of transportation in a reasonably comparable manner.

There are further definitional issues to be resolved. Should travel include "cruise" or "tour" type trips? The main estimates generally exclude boat cruises, charter bus trips and "tourist trains"; in other words, the focus is on travel whose main purpose is to get from point A to point B. Supplementary information is provided, however, on some elements of cruise travel in subsection 1.5. If one is assembling data on domestic travel, which is the subject of this section, a further issue is the treatment of the domestic portion of international trips.

As discussed in the section entitled "A Data Detour" of *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (pages 56–61), there are two basic sources of data on domestic travel in Canada: Statistics Canada's Canadian Travel Survey (CTS), which asks a sample of Canadians about the intercity trips they have taken over the previous three months, and data reported by carriers on passengers carried. For travel by car, the CTS provides some data, but car data that correspond directly to the carrier data for the public means of travel do not exist. For private car use, information on volume of traffic on highways or, failing that, on fuel consumption and on motor vehicle registrations provides a partial parallel to the carrier data for the public means of passenger transportation.

The CTS provides an estimate of domestic (and international) trips taken in excess of 80 kilometres in one-way distance. The trip is identified by the primary means used. Thus, as noted in the Interim Report, a trip from Victoria to Kingston that involves travel by bus and ferry from Victoria to Vancouver, by airplane from Vancouver to Toronto, and by train from Toronto to Kingston would be recorded as one air trip. Estimates are provided of both numbers of trips and total passenger-kilometres travelled.

The estimates of total travel by the different means of transportation are certainly of interest, but they give an incomplete view of intercity travel in Canada for a number of reasons:

- As illustrated by the Victoria to Kingston example, information on the role of any secondary modes used in the course of a trip is not provided.
- Travel within Canada by residents of other countries is not included.
- Respondents to the CTS may fail to recall some trips, especially shorter car and bus trips.
- Finally, information on trips under 80 kilometres in length would be useful for some purposes. Such trips likely account for a significant portion of the business of the ferry and intercity bus industries, some of the business of the passenger rail industry, and a substantial portion of use of highways by cars.

Table 2(2)-1, which is an update of Table III-1 of the Royal Commission's Interim Report, shows 1990 estimates of domestic intercity trips or of passengers carried, and of passenger-kilometres travelled, from the Canadian Travel Survey and from carrier data or other sources. As indicated earlier, the carrier data, and the alternative car passenger-kilometre estimate, are more inclusive. They are attempts to measure all domestic travel excluding travel within a single urban or metropolitan area and short car trips on secondary rural roads.

*Table 2(2)-1*

*INFORMATION ON DOMESTIC INTERCITY TRAVEL (FROM ALTERNATIVE SOURCES, 1990)*

| | Car | Air | Intercity bus | Rail (excluding commuters) | Intercity ferries | Total |
|---|---|---|---|---|---|---|
| **I. Trips (one-way) or passengers carried** | | | | | | |
| **CTS-based estimates one-way trips** | | | | | | |
| millions | 243 | 13.1 | 7.5 | 1.6 | 0.7 | **266[a]** |
| percentage | 91% | 5% | 3% | 1% | 0% | **100%** |
| **Carrier-based estimates passengers carried** | | | | | | |
| millions | n/a | 14.1 | 18.2 | 3.8 | 23.5 | **n/a** |
| **II. Passenger-kilometres** | | | | | | |
| **CTS-based estimates** | | | | | | |
| billions | 56.7 | 20.8 | 2.4 | 0.6 | 0.2 | **80.7** |
| percentage | 70% | 26% | 3% | 1% | 0.3% | **100%** |
| **Carrier plus alternative car estimates** | | | | | | |
| billions | 135 | 25.0 | 3.4 | 1.4 | 0.8 | **166** |
| percentage | 82% | 15% | 2% | 1% | 0.5% | **100%** |
| **III. Implicit Average Trip Length** | | | | | | |
| **CTS-based estimates** | | | | | | |
| kilometres | 234 | 1,580 | 325 | 403 | 298 | **304** |
| **Alternative estimates** | | | | | | |
| kilometres | n/a | 1,774 | 187 | 368 | 34 | **n/a** |

[a] **This figure is slightly less than twice the estimate of 134 million domestic round trips referred to in Chapter 2. The latter figure includes travel by other and unspecified means.**

## 1.1 CANADIAN TRAVEL SURVEY ESTIMATES OF TRIPS AND PASSENGER-KILOMETRES

CTS-based estimates of trips are the CTS survey figures for round trips (Statistics Canada, Catalogue No. 87-504) multiplied by two to obtain one-way equivalent figures for comparison with the carrier-based estimates of passengers carried. The CTS-based estimate of passenger-kilometres is taken from unpublished CTS survey results.

## 1.2 CARRIER-BASED ESTIMATES — PASSENGERS CARRIED

### 1.2.1 Air

Statistics Canada, *Air Passenger Origin and Destination, Domestic Report 1990,* Catalogue No. 51-204, August 1991, Table 3, reports 13 million domestic origin-destination (O-D) trips in 1990. This report, based on data from the "Scheduled Air Passenger O-D Survey," records the total number of trips flown between city-pairs on a subset of large domestic carriers. Since it only includes passenger trips on the scheduled services of nine major airlines, the report underestimates the number of total trips. Data on domestic charter activity and O-D trips entirely on smaller airlines should also be considered.

Statistics Canada, *Air Charter Statistics 1990,* Catalogue No. 51-207 reports that in 1990 almost 330,000 trips were taken aboard domestic charters.

In addition, Statistics Canada's unpublished "System Passenger Origin and Destination Survey" showed that in 1990 almost 3 million O-D trips were taken on the smaller regional and local air carriers in Canada. Only a portion of these trips, however, can be considered as additional trips since many of these smaller airlines interline with the carriers counted by the "Scheduled Air Passenger O-D Survey." In an interline arrangement, passengers from one carrier transfer to another carrier and continue their journey. For example, a passenger flying First Air from Iqaluit, N.W.T., to Ottawa then transferring to Air Canada in Ottawa and continuing to Toronto would be counted as a Scheduled O-D Survey passenger from Iqaluit to Toronto because the itinerary includes a flight stage aboard Air Canada's system. A passenger flying First Air from Iqaluit to Yellowknife would not appear in the Scheduled Air Passenger O-D Survey but would be counted by the System O-D Survey, which measures the scheduled O-D traffic within route systems of all Levels 2 to 5 airlines. There are no data on how many trips recorded by the Scheduled Air Passenger O-D Survey involve smaller carriers. Following the approach of an unpublished

Statistics Canada study, one quarter of the System O-D trips for carriers not included in the Scheduled O-D Survey are counted as separate trips. This amounted to over 700,000 trips in 1990.

Adding the domestic charter O-D trips and the allowance for trips on smaller carriers to the reported 13 million O-D trips yields an overall estimate of 14.1 million trips.

### 1.2.2 Intercity Bus

Bus trips for 1990 were estimated by reducing the 1989 passenger level for the intercity passenger bus industry (Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215) by 7%, the average annual rate at which passengers carried fell between 1984 and 1989. This results in an estimate of 16 million passengers. In addition, bus operators classified as school bus operators, and as charter and sightseeing bus operators also offer some scheduled intercity bus services. Unfortunately, only vehicle-kilometres are recorded for these firms. In order to derive an estimate of passengers carried by these firms, an assumed occupancy rate of 21 passengers per bus was used. Secondly, passengers were assumed to have an average trip length of 100 km — half that estimated for the intercity passenger bus industry. This yields an estimate of 2 million passengers carried on other scheduled services or 14% of the intercity bus industry figure. The overall estimate of intercity bus passengers is 18.2 million.

### 1.2.3 Rail

The rail passengers figure is the sum of VIA Rail passengers (Statistics Canada, *Rail in Canada 1990*, Catalogue No. 52-216, Figure 3.10), and unpublished statistics for other intercity railways. Commuter services are excluded. In 1990, about 3.8 million passengers were carried, a significant reduction from 1988, reflecting the elimination of about half of the VIA Rail network.

### 1.2.4 Intercity Ferries

Intercity ferry passengers carried include all domestic passengers on BC Ferries, Marine Atlantic, Northumberland Ferries, other Atlantic region ferries, Ontario Northland, and the longer St. Lawrence River crossings, primarily those of the Société des Traversiers du Québec. Data were obtained either from annual reports or directly from the carriers. In 1990, these services together transported about 23.5 million passengers.

## 1.3 CARRIER-BASED ESTIMATES — PASSENGER-KILOMETRES

### 1.3.1 Air

Domestic air passenger-kilometres are taken from Statistics Canada, *Canadian Civil Aviation 1990*, Catalogue No. 51-206, November 1991, Table 2.2. Data include both scheduled and charter domestic passenger-kilometres of Levels 1 to 4.

### 1.3.2 Intercity Bus

The bus passenger-kilometres figure is an estimate derived using 1989 data on bus-kilometres for intercity passenger bus operators and for other passenger bus operators that offer scheduled intercity services (for example, school bus, and charter and sightseeing establishments), together with an assumed average occupancy rate (passengers per bus). In 1989, intercity services produced almost 170 million bus-kilometres. Assuming an occupancy of 21 passengers per bus,[1] yields an estimate of over 3.5 billion passenger-kilometres. Bus passenger-kilometres have been falling steadily at about 3% per annum since the mid-1980s; the estimate for 1990 is thus about 3.4 billion passenger-kilometres.

### 1.3.3 Rail

The rail passenger-kilometres figure is the sum of statistics for VIA Rail (Statistics Canada, *Rail in Canada 1990*, Catalogue No. 52-216, Figure 3.10) and unpublished data on the other intercity railways.

Commuter services are again excluded. In 1990, about 1.4 billion passenger-kilometres were recorded, a significant reduction from 1988.

### 1.3.4 Intercity Ferries

Ferry passenger-kilometres are calculated using the number of passengers carried on each route and an estimate of the average distance sailed on the route. This yields an estimate for 1990 of about 0.8 billion passenger-kilometres.

## 1.4 ALTERNATIVE ESTIMATE OF CAR PASSENGER-KILOMETRES

The estimate is simply two thirds of the Royal Commission staff estimate of 205 billion passenger-kilometres for total car travel on highways (including use of small vans and light trucks for passenger transportation purposes). The basis for the total highway travel estimate is described in Annex 1. The estimate of total car travel on highways is itself subject to a considerable range of uncertainty, particularly in the assumption as to the average number of people occupying a car during highway travel. Multiplication by the two-thirds factor makes a very rough allowance for the fact that provincial highways that pass through metropolitan areas are often heavily used for urban travel. Thus, a considerable fraction of total highway use consists of trips that are not intercity but are entirely within metropolitan areas.

The carrier and alternative car estimates are considerably higher than the CTS estimates for all modes except air. Because they give a more complete — although in some cases very approximate — view of the role of the different modes, they receive primary emphasis in most of the following sections of these Notes to Chapter 2.

The 70% estimate from the CTS of the share of the car in intercity passenger-kilometres should be considered a minimum estimate. It seems very likely that a larger fraction of car trips than of trips by other modes, especially air, are missed from the survey due to failure of the respondent to recall all trips taken. Further, as noted earlier, for some purposes there is interest in trips under 80 kilometres in one-way distance, of which the car would be expected to have an overwhelming share, followed by bus. The rough alternative estimates of intercity car passenger-kilometres, when combined with the other carrier-based estimates, result in a car share of 82%. The very approximate nature of the allowance for the intercity share of total highway travel is reflected in the reference in the section "How Canadians Travel," in Chapter 2 of Volume 1, to car travel as accounting for "around 80 percent of all domestic intercity passenger-kilometres travelled in Canada."

## 1.5 TOUR/CRUISE TRAVEL

As noted, Table 2(2)-1 is intended to cover intercity travel, rather than specialized sightseeing tours or cruises. In part this is because sightseeing tours do not generally provide an effective alternative for people whose main objective is to travel from point A to point B. Some bus group charters, however, may be a substitute for use of public carriers. Data on numbers of tour/cruise passengers and passenger-kilometres tend to be even sketchier than other travel data.

The "carrier-based," and presumably the "CTS-based," estimates in Table 2(2)-1 do include domestic air travel by "charter services" — where charter in this case refers to aircraft operators who sell individual seats in an aircraft flying at times specified by the operator. (The table does not include air travel on small chartered aircraft where the aircraft itself is chartered to take the travellers to a destination on a schedule specified by the travellers.)

The carrier-based estimates in Table 2(2)-1 include little if any travel by "tour trains." Until recently, tour trains have generally been confined to short day trips, but with the Rocky Mountaineer service, and potentially other services in the future, this type of train travel may become more important.

The bus and boat estimates are more substantially affected by the treatment of charter/tour/cruise travel. Some charter/tour/cruise travel by bus and boat is presumably included in the CTS-based estimates (the "ferries" heading should read "boat" as far as the CTS estimates are concerned). For bus, as shown later, the number of bus-kilometres of service provided by operators that specialize in charter services is more than one third the level of bus-kilometres in intercity service by intercity bus operators. As charter services almost certainly operate with higher average occupancy rates, in passenger-kilometre terms they may well equal half or more of the scheduled intercity level. The table shows a set of estimates of non-urban charter activity, together with the assumptions on which the estimates are based.

With about 200,000 passengers,[2] cruise ship operations in Canadian waters may well generate revenues of the same order as intercity ferry operations ($300 million a year). The number of cruise passengers is divided about 90% west coast and 10% inland and east coast. The cruise industry includes excursion boats, with no overnight accommodation, and cruise ships. The passenger and rough revenue estimates given earlier, however, do not include day excursion operations.

Cruise, as opposed to excursion, ships are mainly foreign registered (foreign flag), built and crewed. Most of them are operated by foreign companies although some may be under charter to Canadian companies. The Canadian registered ships are the smaller ones and generally sail on the Great Lakes, St. Lawrence and east coast. Recent changes to legislation permit foreign registered ships above 250 berths to engage in international cruise service but reserve to Canadian registry service by vessels of 250 berths or less.

*Table 2(2)-2*

*INTERCITY SCHEDULED AND CHARTER BUS PASSENGER-KILOMETRES ESTIMATE, 1989*

*(MILLIONS)*

| Operator | Intercity scheduled service | | Charter (non-urban)[a] | |
|---|---|---|---|---|
| | bus-km | pass-km[b] | bus-km | pass-km[c] |
| Intercity bus class 1 and 2 | 156 | 3,276 | 20[d] | 692 |
| Other passenger bus[e] | 6 | 126 | 49 | 1,711 |
| School bus[e] | 5 | 105 | [f] | |
| Intercity bus class 3[g] | 2 | 42 | | |
| **Total** | **169** | **3,549[h]** | **69** | **2,403** |

**Source: Derived from data from Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215, 1989.**

**a. The charter total is reduced by 25% as a rough allowance for local (urban) activity.**

**b. Assuming an average load of 21 passengers.**

**c. Assuming an average load of 35 passengers.**

**d. Calculated from the proportion of charter revenues to unit toll revenues.**

**e. School busing not included.**

**f. Although school bus charters do on occasion range beyond the 80 km threshold, this class of operators has been excluded as constituting primarily local activity.**

**g. Estimated from 1988 data (Class 3 data were dropped in 1989).**

**h. This figure, reduced by the recent average annual rate of decrease, is the basis for the estimate of 1990 intercity bus passenger-kilometres in Table 2(2)-1.**

## 2. ESTIMATES OF DOMESTIC INTERCITY PASSENGER TRANSPORTATION MODAL SHARES, 1930–1990

Chart 2-5, in Chapter 2, shows rough estimates of the car, bus, rail and air shares, measured in passenger-kilometres, of Canadian intercity transportation over the last 60 years. As discussed in Section 1 of Notes to Chapter 2, the estimate of passenger-kilometres of intercity travel by car is very rough. The widest margins of uncertainty arise due to lack of good information on the average number of persons occupying cars when they are used for intercity travel, and on the fraction of car travel on highways that is intercity in nature. The estimate of passenger-kilometres of intercity travel by bus is also subject to significant uncertainty. Thus Chart 2-5 and the tables in this section only provide a very general indication of past trends — not precise estimates.

## 2.1 BASIS FOR ESTIMATES

As will be set out in more detail later, reasonably good data on air and rail passenger-kilometres of travel exist for most or all of the historical period under consideration. For car and bus, however, there are no data that directly measure travel. In these latter cases, the extrapolation backwards from the present is based on other statistical series, such as fuel consumption, which shed some light on the way the total amount of travel by these means has changed over time.

### 2.1.1 Car

The very approximate backwards extrapolation of the level of intercity car travel in effect makes use of historical data on gasoline sales, estimates of the fraction used in cars, and estimates of average fuel economy, to produce estimates of changes in car vehicle-kilometres. Then, multiplying by an index of assumed occupancy rates provides estimates of changes in passenger-kilometres of travel. The derivation of the estimates for passenger automobiles is set out in more detail later. Component historical series used are shown in Table 2(2)-3. (The explanation is organized in terms of the columns in the table.)

1. Data on sales of gasoline in Canada taxed for use by road motor vehicles are available for the full period covered. For the period 1977 to 1989, however, the source data do not include gasoline sales in Alberta and/or Saskatchewan for years in which no gasoline taxes were levied. The series shown in the table, however, has been adjusted to include an approximate allowance for sales in these provinces over the periods in which taxes were not levied.
2. In the absence of extended Canadian historical data series on the fraction of gasoline sales for use in automobiles, it is assumed that the Canadian fraction changed in proportion to the corresponding fraction for the United States. Data on total gasoline sales for road motor vehicles, and for automobiles, for the United States are available from 1948 to 1990. As well, closely related data are available for earlier years; this allows an approximate series to be produced for the years prior to 1948.

*Table 2(2)-3*

### SERIES USED TO EXTRAPOLATE BACKWARDS THE 1990 ESTIMATE OF AUTOMOBILE PASSENGER-KILOMETRES

| Year | (1) Net sales of gasoline for road motor vehicles — Canada (billions of litres) | (2) Auto gasoline sales as share of road gasoline sales — U.S. (%) | (3) Auto fuel efficiency — U.S. (litres/ 100 km/per vehicle) | (4) Index of vehicle-kilometres ((1 × 2) ÷ 3) (1990= 100) | (5) Population per registered auto — Canada (persons per car) | (6) Index of occupancy rate — Canada (1990= 100) | (7) Index of passenger-kilometres (4 × 6) (1990= 100) |
|---|---|---|---|---|---|---|---|
| 1930 | 2.1 | 77.2 | 15.4 | 5.7 | 9.6 | 148.3 | 8.4 |
| 1932 | 2.1 | 76.7 | 15.4 | 5.6 | 11.1 | 148.3 | 8.3 |
| 1934 | 2.2 | 76.2 | 15.4 | 5.8 | 11.2 | 149.7 | 8.6 |
| 1936 | 2.4 | 75.7 | 15.4 | 6.4 | 10.5 | 149.0 | 9.5 |
| 1938 | 2.9 | 75.1 | 15.4 | 7.5 | 9.6 | 148.3 | 11.2 |
| 1940 | 3.2 | 74.6 | 15.4 | 8.3 | 9.2 | 147.0 | 12.2 |
| 1942 | 2.8 | 72.9 | 15.5 | 7.0 | 9.6 | 146.3 | 10.3 |
| 1944 | 2.6 | 68.2 | 15.7 | 6.1 | 10.1 | 147.0 | 9.0 |
| 1946 | 4.5 | 73.8 | 15.8 | 11.5 | 10.0 | 147.7 | 16.9 |
| 1948 | 5.2 | 71.0 | 15.8 | 12.5 | 8.6 | 145.6 | 18.2 |
| 1950 | 6.3 | 69.1 | 15.8 | 14.9 | 7.2 | 143.6 | 21.4 |
| 1952 | 7.8 | 70.3 | 16.1 | 18.4 | 6.3 | 140.3 | 25.8 |
| 1954 | 9.2 | 71.3 | 16.2 | 21.8 | 5.6 | 138.3 | 30.2 |
| 1956 | 11.2 | 72.3 | 16.4 | 26.5 | 5.0 | 136.2 | 36.1 |
| 1958 | 12.4 | 73.8 | 16.5 | 30.0 | 4.7 | 134.2 | 40.2 |
| 1960 | 13.7 | 74.2 | 16.5 | 33.2 | 4.4 | 132.9 | 44.1 |
| 1962 | 14.8 | 74.4 | 16.4 | 36.2 | 4.1 | 131.5 | 47.6 |
| 1964 | 16.8 | 74.0 | 16.5 | 40.5 | 3.8 | 129.5 | 52.4 |
| 1966 | 19.4 | 78.5 | 16.7 | 49.3 | 3.7 | 127.5 | 62.8 |
| 1968 | 21.6 | 79.1 | 17.0 | 54.4 | 3.4 | 125.5 | 68.2 |
| 1970 | 24.1 | 79.2 | 17.4 | 59.1 | 3.2 | 122.8 | 72.5 |
| 1972 | 26.9 | 79.0 | 17.6 | 65.2 | 2.9 | 120.1 | 78.4 |
| 1974 | 30.3 | 77.8 | 17.5 | 72.5 | 2.6 | 116.8 | 84.6 |
| 1976 | 32.4 | 75.9 | 17.4 | 76.3 | 2.6 | 112.8 | 86.0 |
| 1978 | 34.7 | 72.8 | 16.8 | 81.2 | 2.4 | 109.4 | 88.8 |
| 1980 | 35.7 | 71.0 | 15.2 | 89.9 | 2.3 | 107.4 | 96.5 |
| 1982 | 31.2 | 71.1 | 14.1 | 84.6 | 2.3 | 106.0 | 89.7 |
| 1984 | 30.4 | 67.8 | 13.2 | 84.0 | 2.3 | 104.0 | 87.3 |
| 1986 | 30.5 | 66.7 | 12.9 | 85.2 | 2.2 | 104.0 | 88.6 |
| 1988 | 32.1 | 65.5 | 11.8 | 95.6 | 2.1 | 102.0 | 97.5 |
| 1990 | 31.8 | 65.7 | 11.2 | 100.0 | 2.1 | 100.0 | 100.0 |

**Sources:** *Fuel sales — Canada:* 1930–1944: Dominion Bureau of Statistics, *Highway and the Motor Vehicle in Canada*, Catalogue No. 53-201, 1938 and 1944 editions. 1945–1955: D.B.S., *Motor Vehicle*, Catalogue No. 53-203, 1950 and 1955 editions. 1956–1990: Statistics Canada, *Road Motor Vehicles — Fuel Sales*, Catalogue No. 53-218, various issues.

*Auto gasoline share and fuel efficiency — U.S.:* 1936–1985: Federal Highway Administration, *Highway Statistics, Summary to 1985*, p. 9 and pp. 229–32. 1986–1990: FHWA, *Highway Statistics*, 1987–1990 editions, Tables MF–21A and VM–1.

*Vehicle registrations — Canada:* 1930–1975: Statistics Canada, *Historical Statistics of Canada*, 2nd ed., ed. F. H. Leacy (Ottawa: Supply and Services Canada, 1983), Series T147–T150. 1976–1990: Statistics Canada, *Road Motor Vehicle — Registrations*, Catalogue No. 53-219, various issue years.

*Population — Canada:* 1930–1990: Statistics Canada, *Canadian Economic Observer, Historical Statistical Supplement 1990/1991*, Catalogue No. 11-210, July 1991, pp. 96–97.

*Occupancy rate:* Royal Commission staff estimates.

3. In the absence of extended Canadian historical data series on average fuel economy for passenger automobiles, it is also assumed that average fuel economy in Canada varied in line with fuel economy in the United States. Data were available from 1936 to 1990 for the United States; the 1936 value was assumed to apply from 1930 to 1935.

   In deriving an estimate of the change over time in intercity vehicle-kilometres, it would be desirable also to allow for any change in the intercity share of total car travel. There are no directly relevant data for Canada or the United States. U.S. data, however, show an approximately constant share for vehicle-miles on interstate highways and main rural roads relative to total automobile vehicle-miles. The estimate makes no allowance for any possible change in the share of intercity driving in total car travel.

4. Column 4 is the product of columns 1 and 2, divided by column 3, and indexed to 1990. It shows automobile vehicle-kilometres over this period.

5. and 6.

   There is also little direct information on average occupancy, but there is reason to believe that the average occupancy rate has fallen as car ownership has become more widespread. Canadian data do exist on the ratio of car passengers to car drivers killed in car accidents for the period 1942 to the present. This ratio has declined fairly steadily since 1942, suggesting that the average occupancy ratio has also declined. While the ratio of car occupant fatalities to car driver fatalities is not necessarily a good indicator of the average level of car occupancy, it seems reasonable to assume that, over time, these two series would tend to move in step. The automobile passenger-kilometre estimates assume that, over the historical period, the occupancy rate maintained a constant proportionate relation to the ratio of total passenger and driver fatalities to driver fatalities. A simple statistical relation between the occupancy rate from car fatalities and the ratio of population to registered automobiles was estimated for the period from 1942 to 1990. Together with information on the ratio of population to registered automobiles for the full historical period (column 5), this was used to create an occupancy index (column 6) for the full historical period.

7. Multiplying the index of vehicle-kilometres (column 4) by the index of occupancy rates provides an overall index of automobile passenger-kilometres. Given the further assumption of no change in the ratio of intercity automobile travel to total automobile travel, this is also an index of intercity passenger-kilometres. Column 7 shows this overall index with 1990 = 100 as the base value.

The overall index in column 7 is used to extrapolate backwards from the estimated level of intercity automobile travel for 1990 (Annex 1) to produce the very rough historical estimates of intercity automobile passenger-kilometres in Table 2(2)-5. A parallel approach is used to extrapolate backwards from the 1990 estimate of intercity passenger travel in light trucks. Again, U.S. data are used to provide indexes of changes in the share of gasoline consumed by light trucks, and of changes in light-truck fuel economy. A number of additional adjustments were made to the published U.S. historical series to produce the estimate for light trucks shown in Table 2(2)-5.

### 2.1.2 Bus

Intercity bus passenger-kilometres were extrapolated backwards from 1990 using the series shown in Table 2(2)-4.

Table 2(2)-4

## SERIES USED TO EXTRAPOLATE BACKWARDS THE 1990 ESTIMATE OF INTERCITY BUS PASSENGER-KILOMETRES

| Year | (1) Bus-km (millions) | (2) Average bus capacity (seats) | (3) Index of bus pass-km (1990=100) |
|---|---|---|---|
| 1930 | | | 8.1 |
| 1932 | | | 6.9 |
| 1934 | | | 7.5 |
| 1936 | | | 10.3 |
| 1938 | | | 9.4 |
| 1940 | | | 16.9 |
| 1942 | 82.4 | 24.6 | 31.7 |
| 1944 | 84.3 | 24.9 | 32.8 |
| 1946 | 136.9 | 26.9 | 57.6 |
| 1948 | 173.3 | 29.1 | 78.9 |
| 1950 | 168.2 | 29.4 | 77.3 |
| 1952 | 165.7 | 30.3 | 78.4 |
| 1954 | 150.4 | 31.2 | 73.2 |
| 1956 | 142.7 | 32.7 | 72.9 |
| 1958 | 130.2 | 34.3 | 69.7 |
| 1960 | 137.9 | 34.9 | 75.2 |
| 1962 | 142.6 | 36.3 | 80.9 |
| 1964 | 148.0 | 36.8 | 85.0 |
| 1966 | 170.3 | 38.1 | 101.4 |
| 1968 | 177.7 | 38.7 | 107.4 |
| 1970 | 173.3 | 39.3 | 106.3 |
| 1972 | 172.7 | 39.5 | 106.7 |
| 1974 | 172.1 | 39.8 | 107.1 |
| 1976 | 181.4 | 40.1 | 113.7 |
| 1978 | 189.7 | 40.4 | 119.7 |
| 1980 | 201.5 | 40.7 | 128.1 |
| 1982 | 196.0 | 41.0 | 125.4 |
| 1984 | 180.3 | 41.3 | 116.2 |
| 1986 | 172.2 | 41.6 | 111.8 |
| 1988 | 156.8 | 41.9 | 102.5 |
| 1990 | 152.4 | 42.0 | 100.0 |

**Sources:** ***Bus-km and capacity to 1970*****: 1941–1955: Dominion Bureau of Statistics, *Motor Carriers — Freight — Passenger*, Catalogue No. 53-D-20. 1956–1970: Statistics Canada, *Passenger Bus Statistics*, Catalogue No. 53-215. 1974–1989: Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215.**

**Notes:** **Index for 1930–1940 based on linkage to statistics compiled by Gordon D. Campbell, "An Analysis of Highway Finance and Road User Imposts in Canada," (Ph.D. thesis, Purdue University, 1956), Table 32, p. 258.**

**A constant load factor of 50% of average capacity was assumed throughout the period.**

1. Published data on vehicle-kilometres by buses operated by the intercity bus industry were available for the period 1941 to 1990. Data are available for bus operators with annual revenues in excess of $20,000 for years up to 1970 and for bus operators with annual revenues in excess of $100,000 for 1974 and later years.

   These two series were used without adjustment, in spite of the reduction in coverage at the time of the shift from $20,000 to $100,000 and in spite of the tendency to relative underestimation for the earlier years in each series. Due to inflation, the exclusion of operators with revenues under $20,000 or $100,000 presumably involves the exclusion of relatively more, and relatively larger, operators in the early years of the series than in the later years. As data were not published for 1972, the figure for that year is the average of the 1970 and 1974 values.

   No allowance is made for any possible change in the relative importance of scheduled intercity bus service provided by school and charter bus operators not classified in the intercity bus industry. As indicated in Section 1 of these Notes to Chapter 2, in 1990 such operators were estimated to provide 7% of total intercity bus passenger-kilometres.

2. The size of the average bus has tended to become larger over the historical period. Column 2 shows a rough estimate of the average size of intercity buses in use. This was derived from information on the number of buses by number of seats, which is available for certain years over the period.

3. The index of changes in the amount of bus travel (column 3) is the product of columns 1 and 2, with 1990 = 100 as the base. It is assumed that average occupancy as a percent of seating capacity has remained constant over the period (50%).

For the years from 1930 to 1940, for which there are no published data on intercity bus vehicle-kilometres, the index has been extrapolated backwards from 1941 on the basis of estimates of intercity bus passenger-kilometres in a study by Gordon Campbell.[3]

The resulting index for 1930 to 1990 is applied to the 1990 estimate of intercity bus passenger-kilometres (Table 2(2)-1) to produce the rough historical estimate of intercity bus passenger-kilometres in Table 2(2)-5.

### 2.1.3 Air

Published passenger-kilometre data are available for domestic scheduled air services for the years 1936 to 1990. These data were adjusted by adding an estimate of passenger-kilometres on domestic charter services to produce the series in Table 2(2)-5. Estimated passenger-kilometres on domestic charter services were equal to 8%, on average, of total domestic passenger-kilometres from 1964 to 1990.

Published data on total passenger-kilometres provided by Canadian air carriers are available for 1930 to 1935; the domestic portion was assumed to be equal to 85% for this period based on the portion in the immediately following years.

### 2.1.4 Rail

Published data exist on total rail passenger-kilometres back to 1910. Unpublished data from Statistics Canada on passenger-kilometres on commuter services from 1970 onwards were used to produce estimates of intercity rail passenger-kilometres. The commuter share pre-1970 was assumed to equal the 9% average share of the early 1970s.

## 2.2 SUMMARY TABLES ON INTERCITY PASSENGER TRAVEL

The estimates of passenger-kilometres of domestic intercity travel by the different means of intercity passenger transportation, derived as discussed earlier, are presented in Table 2(2)-5. The next three tables present the same information in alternative forms to facilitate various types of analysis. Table 2(2)-6 shows the average annual growth rates for the series by decade and for certain longer intervals. Table 2(2)-7 expresses the estimates as percentage shares of total domestic intercity travel; these percentage shares are also displayed in Chart 2-5 of Chapter 2, Volume 1. Table 2(2)-8 presents the estimates in terms of passenger-kilometres of travel per capita. This per capita table is intended to provide an impression of changes in amount of travel abstracting from overall growth in population. The per capita figures — that is, the estimates of total amounts of domestic intercity travel in Table 2(2)-5 divided by total population — obviously are not estimates of total annual travel or the change in total annual travel, by the average **user** of the mode in question. Only a fraction of the population uses any given mode and this fraction has almost certainly changed substantially over the historical period considered, although there are few direct data on this point. The fraction of the population using the air mode in a year will have risen very substantially. The fraction using cars for intercity travel probably rose somewhat, especially over the first three or four decades of the period; the fraction using intercity rail has almost certainly declined substantially since World War II; and the fraction using intercity bus may well have declined since the 1950s.

Given the very rough nature of the estimates of intercity travel by car and bus, the tables only serve to provide a general sense of the trends in intercity travel over time. They do, however, provide an adequate basis for the following general observations:

- Car travel already accounted for a large share of intercity travel by the 1930s. The absolute amount of car travel, and even more so its share of total travel, fell during World War II. Presumably this was primarily a result of the rationing of gasoline and the fact that the government used rail and bus for very large movements of military personnel. Car rapidly returned to a dominant position after the war, and its share appears to have been relatively stable since — possibly increasing modestly into the 1960s and then declining modestly over the last two decades as air travel has increased dramatically.

Table 2(2)-5

## DOMESTIC INTERCITY TRAVEL IN CANADA, 1930–1990

(BILLIONS OF PASSENGER-KILOMETRES)

| Year | "Car" | | | Sched./ charter air | Intercity rail | Intercity bus | Total intercity travel |
|---|---|---|---|---|---|---|---|
| | Total | Auto. | Light trucks/ vans | | | | |
| 1930 | 10.2 | 9.7 | 0.5 | 0.007 | 3.3 | 0.4 | 13.9 |
| 1932 | 10.1 | 9.6 | 0.5 | 0.004 | 2.0 | 0.3 | 12.4 |
| 1934 | 10.5 | 10.0 | 0.5 | 0.009 | 2.1 | 0.3 | 13.0 |
| 1936 | 11.7 | 11.1 | 0.6 | 0.012 | 2.4 | 0.5 | 14.5 |
| 1938 | 13.7 | 13.0 | 0.7 | 0.014 | 2.4 | 0.4 | 16.5 |
| 1940 | 15.0 | 14.2 | 0.8 | 0.059 | 3.0 | 0.8 | 18.8 |
| 1942 | 12.6 | 11.9 | 0.7 | 0.104 | 6.8 | 1.1 | 20.6 |
| 1944 | 11.2 | 10.4 | 0.8 | 0.2 | 9.4 | 1.1 | 21.9 |
| 1946 | 20.8 | 19.6 | 1.2 | 0.3 | 6.4 | 2.0 | 29.3 |
| 1948 | 22.5 | 21.1 | 1.5 | 0.4 | 4.8 | 2.7 | 30.4 |
| 1950 | 26.7 | 24.9 | 1.9 | 0.6 | 3.8 | 2.6 | 33.8 |
| 1952 | 32.1 | 29.9 | 2.2 | 0.9 | 4.3 | 2.7 | 40.0 |
| 1954 | 37.5 | 34.9 | 2.6 | 1.2 | 3.9 | 2.5 | 45.1 |
| 1956 | 44.9 | 41.8 | 3.0 | 1.6 | 4.0 | 2.5 | 52.9 |
| 1958 | 49.8 | 46.6 | 3.2 | 2.0 | 3.4 | 2.4 | 57.5 |
| 1960 | 54.7 | 51.1 | 3.6 | 2.7 | 3.1 | 2.6 | 63.0 |
| 1962 | 59.0 | 55.2 | 3.9 | 3.4 | 2.8 | 2.8 | 68.0 |
| 1964 | 65.7 | 60.8 | 5.0 | 3.7 | 3.7 | 2.9 | 76.0 |
| 1966 | 77.4 | 72.8 | 4.6 | 5.1 | 3.5 | 3.4 | 89.5 |
| 1968 | 84.2 | 79.1 | 5.1 | 6.5 | 3.5 | 3.7 | 97.8 |
| 1970 | 90.1 | 84.1 | 6.0 | 8.8 | 3.1 | 3.6 | 105.7 |
| 1972 | 98.3 | 90.9 | 7.5 | 9.9 | 2.8 | 3.6 | 114.6 |
| 1974 | 107.6 | 98.1 | 9.5 | 13.9 | 2.5 | 3.6 | 127.6 |
| 1976 | 110.8 | 99.7 | 11.2 | 14.5 | 2.4 | 3.9 | 131.6 |
| 1978 | 116.3 | 102.9 | 13.4 | 16.3 | 2.5 | 4.1 | 139.2 |
| 1980 | 127.5 | 111.9 | 15.7 | 21.0 | 2.7 | 4.4 | 155.5 |
| 1982 | 118.5 | 103.9 | 14.6 | 18.9 | 2.1 | 4.3 | 143.8 |
| 1984 | 117.1 | 101.2 | 15.8 | 19.4 | 2.3 | 4.0 | 142.8 |
| 1986 | 119.2 | 102.7 | 16.4 | 21.9 | 2.2 | 3.8 | 147.0 |
| 1988 | 131.6 | 113.0 | 18.6 | 24.6 | 2.3 | 3.5 | 162.0 |
| 1990 | 135.0 | 115.9 | 19.1 | 25.0 | 1.4 | 3.4 | 164.8 |

**Sources:** *Car and light truck:* Index of automobile passenger-kilometres (Table 2(2)-3) applied to 1990 level from Annex 1. Similar approach for light trucks. See subsection 2.1.1 of text.

*Air:* 1930: *Canada Year Book 1931*, p. 698. 1931–1935: *Canada Year Book 1936*, p. 702. 1936–1945: M. C. Urquhart and K. Buckley, *Historical Statistics of Canada*, 1st ed. (Toronto: Macmillan, 1965), p. 551, Series 241. 1946–1975: Statistics Canada, *Historical Statistics of Canada*, 2nd ed., ed. F. H. Leacy (Ottawa: Supply and Services Canada, 1983), series T200. 1976–1987: Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, October–December issues. 1988–1990: Statistics Canada, *Canadian Civil Aviation*, Catalogue No. 51-206, Table 2.3, and text.

***Total rail passenger-kilometres:*** **1930–1945: M. C. Urquhart and K. Buckley, *Historical Statistics of Canada,* 1st ed. (Toronto: Macmillan, 1965), p. 535, Series 118. 1946–1975: Statistics Canada, *Historical Statistics of Canada,* 2nd ed., ed. F. H. Leacy (Ottawa: Supply and Services Canada, 1983), series T45. 1976–1987: Statistics Canada, *Rail in Canada 1987,* Catalogue No. 52-216, November 1989, p. 32. 1988–1990: Statistics Canada, *Rail in Canada 1990,* Catalogue No. 52-216, July 1992, Figure 1.6.**

***Intercity rail passenger-kilometres:*** **1970–1981: Statistics Canada, *Railway Transport: Part IV, Operating and Traffic Statistics,* Catalogue No. 52-210, Table 1. 1982–1990: Unpublished data from Transportation Division, Statistics Canada, and text.**

***Bus:*** **See Table 2(2)-4 and text.**

**Note:** **Due to rounding, components may not total exactly.**

## Table 2(2)-6

## AVERAGE ANNUAL GROWTH RATES PER DECADE AND FOR LONGER PERIODS — DOMESTIC INTERCITY TRAVEL IN CANADA, 1930–1990

(PERCENT PER ANNUM)

| | "Car" | | | | | | |
|---|---|---|---|---|---|---|---|
| | Auto. | Light trucks/ vans | "Car" subtotal | Sched./ charter air | Intercity rail | Intercity bus | Total intercity travel |
| 1930–1940 | 3.9 | 4.9 | 3.9 | 23.1 | –1.1 | 7.6 | 3.1 |
| 1940–1950 | 5.8 | 8.9 | 6.0 | 26.4 | 2.6 | 13.0 | 6.1 |
| 1950–1960 | 7.5 | 6.7 | 7.4 | 15.9 | –2.2 | –0.3 | 6.4 |
| 1960–1970 | 5.1 | 5.4 | 5.1 | 12.6 | 0.0 | 3.5 | 5.3 |
| 1970–1980 | 2.9 | 10.0 | 3.5 | 9.0 | –1.4 | 1.9 | 3.9 |
| 1980–1990 | 0.4 | 2.0 | 0.6 | 1.8 | –6.3 | –2.4 | 0.6 |
| 1930–1960 | 5.7 | 6.8 | 5.8 | 21.7 | –0.2 | 6.6 | 5.2 |
| 1960–1990 | 2.8 | 5.7 | 3.1 | 7.7 | –2.6 | 1.0 | 3.3 |
| 1930–1990 | 4.2 | 6.3 | 4.4 | 14.5 | –1.4 | 3.8 | 4.2 |

**Source: Table 2(2)-5.**

*Table 2(2)-7*

## DOMESTIC INTERCITY TRAVEL IN CANADA, 1930–1990

(PERCENTAGE SHARES OF TOTAL PASSENGER-KILOMETRES)

| | "Car" | | | | | | |
|---|---|---|---|---|---|---|---|
| | Auto. (%) | Light trucks/ vans (%) | "Car" subtotal (%) | Sched./ charter air (%) | Intercity rail (%) | Intercity bus (%) | Total intercity travel (%) |
| 1930 | 69.9 | 3.6 | 73.4 | 0.05 | 23.8 | 2.7 | 100.0 |
| 1932 | 77.5 | 4.0 | 81.6 | 0.03 | 15.8 | 2.5 | 100.0 |
| 1934 | 77.1 | 4.1 | 81.2 | 0.07 | 16.1 | 2.6 | 100.0 |
| 1936 | 76.3 | 4.1 | 80.4 | 0.08 | 16.3 | 3.3 | 100.0 |
| 1938 | 78.3 | 4.3 | 82.6 | 0.08 | 14.7 | 2.6 | 100.0 |
| 1940 | 75.5 | 4.3 | 79.7 | 0.3 | 15.8 | 4.1 | 100.0 |
| 1942 | 57.8 | 3.5 | 61.2 | 0.5 | 33.0 | 5.2 | 100.0 |
| 1944 | 47.7 | 3.5 | 51.2 | 0.7 | 43.0 | 5.1 | 100.0 |
| 1946 | 66.8 | 3.9 | 70.8 | 0.9 | 21.7 | 6.7 | 100.0 |
| 1948 | 69.4 | 4.8 | 74.2 | 1.4 | 15.6 | 8.8 | 100.0 |
| 1950 | 73.5 | 5.6 | 79.0 | 1.8 | 11.4 | 7.8 | 100.0 |
| 1952 | 74.8 | 5.6 | 80.3 | 2.2 | 10.8 | 6.7 | 100.0 |
| 1954 | 77.5 | 5.7 | 83.2 | 2.6 | 8.7 | 5.5 | 100.0 |
| 1956 | 79.1 | 5.7 | 84.8 | 3.0 | 7.5 | 4.7 | 100.0 |
| 1958 | 81.0 | 5.5 | 86.5 | 3.5 | 5.9 | 4.1 | 100.0 |
| 1960 | 81.1 | 5.7 | 86.7 | 4.3 | 4.9 | 4.1 | 100.0 |
| 1962 | 81.2 | 5.7 | 86.9 | 5.0 | 4.1 | 4.0 | 100.0 |
| 1964 | 80.0 | 6.5 | 86.5 | 4.8 | 4.8 | 3.8 | 100.0 |
| 1966 | 81.4 | 5.1 | 86.5 | 5.7 | 4.0 | 3.9 | 100.0 |
| 1968 | 80.8 | 5.2 | 86.1 | 6.6 | 3.6 | 3.7 | 100.0 |
| 1970 | 79.5 | 5.7 | 85.3 | 8.4 | 2.9 | 3.4 | 100.0 |
| 1972 | 79.3 | 6.5 | 85.8 | 8.6 | 2.4 | 3.2 | 100.0 |
| 1974 | 76.9 | 7.5 | 84.3 | 10.9 | 1.9 | 2.9 | 100.0 |
| 1976 | 75.7 | 8.5 | 84.2 | 11.0 | 1.8 | 2.9 | 100.0 |
| 1978 | 74.0 | 9.6 | 83.6 | 11.7 | 1.8 | 2.9 | 100.0 |
| 1980 | 71.9 | 10.1 | 82.0 | 13.5 | 1.7 | 2.8 | 100.0 |
| 1982 | 72.3 | 10.1 | 82.4 | 13.2 | 1.5 | 3.0 | 100.0 |
| 1984 | 70.9 | 11.1 | 82.0 | 13.6 | 1.6 | 2.8 | 100.0 |
| 1986 | 69.9 | 11.2 | 81.0 | 14.9 | 1.5 | 2.6 | 100.0 |
| 1988 | 69.8 | 11.5 | 81.2 | 15.2 | 1.4 | 2.2 | 100.0 |
| 1990 | 70.3 | 11.6 | 81.9 | 15.2 | 0.8 | 2.1 | 100.0 |

**Source: Table 2(2)-5.**

*Table 2(2)-8*

## DOMESTIC INTERCITY TRAVEL PER CAPITA IN CANADA, 1930–1990

(PASSENGER-KILOMETRES PER PERSON)

| | "Car" | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Auto.** | **Light trucks/ vans** | **"Car" subtotal** | **Sched./ charter air** | **Intercity rail** | **Intercity bus** | **Total intercity travel** | **Population ('000s)** |
| 1930 | 952 | 48 | 1,000 | 0.7 | 324 | 37 | 1,362 | 10,208 |
| 1932 | 914 | 47 | 961 | 0.4 | 187 | 30 | 1,178 | 10,510 |
| 1934 | 932 | 49 | 981 | 0.8 | 195 | 32 | 1,209 | 10,741 |
| 1936 | 1,010 | 54 | 1,064 | 1.1 | 215 | 43 | 1,324 | 10,950 |
| 1938 | 1,162 | 64 | 1,226 | 1.2 | 219 | 39 | 1,484 | 11,152 |
| 1940 | 1,246 | 70 | 1,316 | 5 | 261 | 68 | 1,651 | 11,381 |
| 1942 | 1,023 | 61 | 1,085 | 9 | 585 | 92 | 1,771 | 11,654 |
| 1944 | 873 | 63 | 936 | 13 | 786 | 93 | 1,830 | 11,946 |
| 1946 | 1,596 | 94 | 1,690 | 21 | 517 | 159 | 2,387 | 12,292 |
| 1948 | 1,644 | 114 | 1,758 | 33 | 371 | 209 | 2,370 | 12,823 |
| 1950 | 1,813 | 137 | 1,949 | 45 | 281 | 192 | 2,467 | 13,712 |
| 1952 | 2,068 | 154 | 2,221 | 62 | 298 | 184 | 2,765 | 14,459 |
| 1954 | 2,286 | 168 | 2,454 | 76 | 256 | 163 | 2,949 | 15,287 |
| 1956 | 2,601 | 189 | 2,790 | 97 | 247 | 154 | 3,288 | 16,081 |
| 1958 | 2,728 | 186 | 2,914 | 117 | 199 | 139 | 3,369 | 17,080 |
| 1960 | 2,859 | 201 | 3,060 | 151 | 173 | 143 | 3,527 | 17,870 |
| 1962 | 2,968 | 208 | 3,177 | 184 | 148 | 148 | 3,657 | 18,583 |
| 1964 | 3,151 | 257 | 3,407 | 190 | 190 | 150 | 3,937 | 19,291 |
| 1966 | 3,637 | 229 | 3,866 | 254 | 177 | 172 | 4,469 | 20,015 |
| 1968 | 3,819 | 248 | 4,067 | 313 | 169 | 176 | 4,725 | 20,701 |
| 1970 | 3,948 | 284 | 4,232 | 415 | 146 | 170 | 4,963 | 21,297 |
| 1972 | 4,167 | 342 | 4,509 | 454 | 127 | 166 | 5,256 | 21,802 |
| 1974 | 4,386 | 426 | 4,812 | 621 | 111 | 163 | 5,706 | 22,364 |
| 1976 | 4,334 | 486 | 4,820 | 632 | 102 | 168 | 5,722 | 22,993 |
| 1978 | 4,377 | 571 | 4,947 | 693 | 105 | 173 | 5,918 | 23,517 |
| 1980 | 4,653 | 652 | 5,305 | 872 | 112 | 181 | 6,470 | 24,043 |
| 1982 | 4,228 | 594 | 4,822 | 770 | 86 | 174 | 5,851 | 24,583 |
| 1984 | 4,052 | 634 | 4,686 | 778 | 94 | 158 | 5,716 | 24,978 |
| 1986 | 4,052 | 648 | 4,700 | 862 | 88 | 150 | 5,800 | 25,353 |
| 1988 | 4,363 | 717 | 5,080 | 951 | 87 | 135 | 6,252 | 25,909 |
| 1990 | 4,357 | 718 | 5,075 | 940 | 53 | 128 | 6,195 | 26,603 |

**Source:** Table 2(2)-5.

- Rail was the dominant intercity public carrier in the 1930s, although it was almost certainly much less important than private use of car even then. During World War II, rail's share may have approached the share of the car, but by the 1950s rail's share was almost certainly below its share in the 1930s, and by the 1960s air had overtaken rail as the public carrier with the largest share of domestic passenger-kilometres. Rail's share fell below that of intercity bus by the 1970s, and has continued to decline with a further sharp drop in 1990 reflecting the reductions in VIA Rail routes. The level of rail passenger-kilometres has shown a declining trend throughout the post-war period.

- Domestic intercity travel by air has grown in a manner typical of a successful new technology (or series of new technologies). It showed high growth rates from a very small base in the early decades and growth rates only moderately higher than the growth of intercity travel as a whole in the most recent period.

- Abstracting from the bulge in domestic intercity bus travel during the special conditions of World War II, the bus share in domestic intercity travel appears to have increased substantially from the 1930s to around 1950. The share has subsequently displayed a downward trend, although the rate of decline has been more gradual than for the rail share. For the 1950s through the 1970s, the decline in the bus share reflected slower growth in travel by intercity bus than in total intercity travel, rather than an absolute decline in the amount of bus travel. During the 1980s, however, there was a decline in total bus passenger-kilometres.

- The total and per capita amounts of domestic intercity travel, taking all modes together, have increased very substantially over the last 60 years — more than quadrupling in per capita terms according to the estimates used here. The increase in per capita travel, however, appears to have slowed markedly in recent years.

## 2.3 EARLIER ESTIMATE OF HISTORICAL TRENDS IN INTERCITY PASSENGER-KILOMETRE SHARES

A set of reasonably comprehensive estimates of intercity modal shares is contained in *Canadian Transportation Economics* by A. W. Currie, published in 1967. These estimates apparently apply to a definition of intercity travel that is similar to that which underlies the estimates presented in these Notes. Little detail on methodology or data sources is provided. Table 2(2)-9 compares Currie's estimates of intercity modal shares with those in Table 2(2)-7.

*Table 2(2)-9*

*Comparison of Estimates of Historical Modal Shares in Domestic Intercity Travel (Passenger-Kilometres)*

|  | Currie | Table 2(2)-7 | Currie | Table 2(2)-7 | Currie | Table 2(2)-7 | Currie | Table 2(2)-7 |
|---|---|---|---|---|---|---|---|---|
| **Year** | **1928** | **1930** | **1951** | **1952** | **1957** | **1958** | **1964** | **1964** |
| Car | 60 | 73 | 72 | 80 | 83 | 86 | 85 | 86 |
| Airplane | — | — | 3 | 2 | 4 | 4 | 5 | 5 |
| Bus | 2 | 3 | 11 | 7 | 5 | 4 | 5 | 4 |
| Train | 38 | 24 | 15 | 11 | 8 | 6 | 5 | 5 |

**Sources: A.W. Currie, *Canadian Transportation Economics* (Toronto: University of Toronto Press, 1967), p. 299 and Table 2(2)-7.**

The two sets of estimates show broadly similar trends, although Currie does estimate a smaller share for car and a higher share for rail, with the differences relative to the estimates developed here diminishing from the 1930s through the 1960s. Given the lack of information on Currie's assumptions, it is not possible to identify the source of the differences. It is possible that the assumption used here, that the intercity share in total car travel was approximately constant over the period at the 1990 level, results in an upward bias in the estimates of the car share for the earlier part of the period. This assumption does receive some support from the fact that U.S. data show little change in the ratio of car travel on highways to total car travel over the historical period considered. It is quite possible, however, especially given the rather rudimentary state of the intercity highway network in much of Canada prior to the 1950s, that use of cars for intercity travel, as a fraction of total car travel, in fact increased over the first three decades of the period covered by our historical estimates. If so, the share of car travel in the estimates in this section is somewhat high for those decades and especially at the beginning of the period.

## 3. INTERNATIONAL COMPARISONS OF MODAL SHARES IN PASSENGER TRANSPORTATION

Chart 2-6 and Table 2-2 in Chapter 2 of Volume 1 present approximate comparisons of the shares of car, bus, train and airplane in total domestic travel by these means for Canada, the United States, Japan, France, West Germany, Italy and the United Kingdom for selected years from 1965 to 1988. The comparative material is used to draw general conclusions as to the prevalence of the dominant role of the car, of the decline in the share of train, and of the rise in the share of air travel in countries whose geography is such that airplanes are attractive as a means of domestic travel.

The footnotes to Table 2-2 warn the reader that the data presented may not be fully comparable across the countries, and thus that small differences in the shares of a mode between two countries may reflect differences in definitions or in data estimation procedures rather than genuine differences in travel patterns. Further, while for purposes of this Royal Commission it would have been preferable to compare shares in domestic intercity travel, reasonably comparable data are only available for total domestic travel, which is the total of urban commuting, other short urban and rural trips, and intercity travel. Thus, the table and chart deal with total domestic travel by these modes. The chief difficulty in measuring domestic intercity travel is to identify the intercity portion of car travel; there is also a grey area in the definition and measurement of urban or rural travel versus intercity travel by bus and train. In Sections 1 and 2 of these Notes to Chapter 2, the rough assumption is made that intercity car travel amounts to two thirds of total car travel on provincial highways. It was judged, however, that there was not sufficient information to make even a rough assumption for the non-North American countries.

This section first sets out the data sources and, where necessary, the assumptions used in developing the estimates. It then briefly discusses the overall results and provides some supplementary information.

## 3.1 THE ESTIMATES

### 3.1.1 Canada

*Car*

The estimates for car (passenger automobiles plus light trucks used for passenger transportation purposes) are based on the estimate for 1990 of total passenger-kilometres of travel by car in Annex 1, Table 2(2)-A1. This estimate is extrapolated backwards using the index of total intercity travel in Table 2(2)-3.

That index was constructed for use as an index of total car travel; it was used earlier as an index of intercity travel by car, given the assumption that the intercity share of total car travel has been constant over time.

*Urban and Intercity Bus*

An estimate of urban bus travel was added to the estimate of passenger-kilometres of intercity bus travel (Table 2(2)-5). Data on vehicle-kilometres of travel by urban buses are available in Statistics Canada's *Urban Transit*, Catalogue No. 53-216, for 1965 and 1970, and *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215, for the later years.

For urban buses, an average occupancy rate of 25% was assumed — approximately the same average occupancy rate as is implicit in the U.S. estimates of urban bus passenger-kilometres. Allowing for some increase in the size of an average bus, this implied an average number of passengers per urban bus of 10.5 in 1965, rising to 12 by 1988.

Note that urban rail transit — subways, light rail systems — have been excluded because of difficulties in obtaining data on rail transit systems for some countries. Obviously, for purposes of comparing total travel, it would be preferable to include this means of transportation. The concluding discussion will refer to supplementary data for certain countries.

### *Intercity and Commuter Rail*

This series includes all train travel for intercity and commuter purposes; it thus includes the separate commuter train systems in Toronto and Montreal. The data for 1965 through 1975 are from Statistics Canada, *Historical Statistics of Canada,* 2nd edition, edited by F. H. Leacy, Supply and Services Canada, Ottawa, 1983, series T45, and for the later years are from Statistics Canada, *Rail in Canada,* 1987, Catalogue No. 52-216.

### *Domestic Scheduled Air*

To enhance international comparability, the data on domestic air in Canada and the other countries are taken from a common source — the International Civil Aviation Organization (ICAO). For 1965 and 1970, they are available in the United Nations *Statistical Yearbook,* 1970, and for the later years are available in ICAO, *Civil Aviation Statistics of the World,* using the latest editions in which data for the year in question are shown. The ICAO data for Canada are slightly lower than the series shown in Table 2(2)-5, because the ICAO does not include data on small airlines.

### 3.1.2 United States

*Car*

Estimates of total vehicle-kilometres of travel by passenger automobiles and light trucks in the United States are made by the U.S. Federal Highways Administration (FHWA), and published in U.S. Department of Transportation, FHWA, *Highway Statistics* (for 1988), and *Summary to 1985* (for 1985 and earlier years). Average occupancy rates for passenger automobiles of 2.1 for 1965, 2.0 for 1970, 1.9 for 1975, 1.8 for 1980, 1.7 for 1985, and 1.5 for 1988 have been used. (Estimates from U.S. Nationwide Personal Transportation Study in U.S. Department of Transportation, *National Transportation Statistics,* July 1990.) For light trucks, occupancy of 1.3 was assumed for all years.

*Bus*

Estimates of intercity bus passenger-kilometres are available for all the years of interest (ENO Foundation, *Transportation in America,* 8th edition, 1990). Estimates of urban bus passenger-kilometres are available for 1980 and later years (U.S. Department of Transportation, *National Transportation Statistics, 1988,* for 1988; and American Public Transit Association, *Transit Fact Book,* 1988 edition, for 1980 and 1985). Urban bus passenger-kilometres were extrapolated to earlier years using data on number of passengers (APTA, *Transit Fact Book*).

*Intercity and Commuter Rail*

Estimates of rail passenger-kilometres were taken from the ENO Foundation's *Transportation in America,* 8th edition, 1990.

*Air*

ICAO data, sources as for Canada.

### 3.1.3 Japan

*Car*

Japanese official statistics contain estimates of car travel based on a sample survey of vehicle users. The data for 1965 through 1980 were taken from *Historical Statistics of Japan*, 1987, Vol. 2, Chapter 8, and for later years from the *Japan Statistical Yearbook*, 1991, Chapter 8.

*Bus*

Data on passenger-kilometres are published in the same sources used for car; they are derived from a Ministry of Transport survey of bus operators.

*Rail*

Passenger-kilometres of travel are measured directly and published in the same sources as the car data.

*Air*

ICAO data, sources as for Canada.

### 3.1.4 France, West Germany, Italy and the United Kingdom

*Car*

Data on passenger-kilometres of travel within the country's territory by vehicles registered in the country are published in European Conference of Ministers of Transport, *Statistical Trends in Transport 1965–1988*, Paris, 1992, page 51. The definition of "car" is believed to be similar to that for Canada and the United States, that is, to include passenger automobiles, vans and light trucks used for passenger transportation.

*Bus*

Same source as for cars (page 52). The average occupancy rates for bus differ sharply among the European countries, ranging from 11 in the United Kingdom to 20 in France. Given the lack of good data on bus occupancy and on bus passenger-kilometres, in most countries, it may be appropriate to treat these passenger-kilometre estimates with some caution.

*Rail*

Same source as for cars (page 31). The data refer to all traffic (both residents and non-residents) on the national rail networks of the countries in question. Independent urban railways, and some other small railways, are not included.

*Air*

ICAO data, sources as for Canada.

## 3.2 SUMMARY TABLES AND GENERAL OBSERVATIONS

Estimates of passenger-kilometres for the different means of transportation are shown in Table 2(2)-10. Table 2(2)-11 shows these same data expressed as modal shares for each country (this table is included as Table 2-2 in Volume 1, and was the basis for Chart 2-6). Table 2(2)-12 shows the data in per capita terms. Overall generalizations regarding the dominant role of the car, the declining role of rail, and the increasing role of air have already been noted. Certain further points may be mentioned, some of which also draw on supplementary data available for some of the countries.

*Car*

In terms of per capita travel by car, by air, and in total, Canada occupies an intermediate position between the United States, and western Europe and Japan.

*Table 2(2)-10*

### Domestic Passenger-Kilometres Travelled by Each Mode, Selected Countries, 1965–1988

*(BILLIONS OF PASSENGER-KILOMETRES)*

| Year | 1965 | 1970 | 1975 | 1980 | 1985 | 1988 |
|---|---|---|---|---|---|---|
| **1. Car (autos, light trucks, and vans)** | | | | | | |
| Canada | 198.2 | 253.9 | 300.9 | 337.9 | 310.7 | 341.3 |
| United States | 2,619.1 | 3,208.5 | 3,581.5 | 3,828.8 | 4,229.3 | 4,600.6 |
| Japan | 54.6 | 211.6 | 264.5 | 328.3 | 398.0 | 556.0 |
| France | 198.0 | 304.7 | 374.8 | 452.5 | 494.4 | 554.3 |
| West Germany | 262.5 | 349.6 | 403.3 | 466.5 | 475.8 | 550.5 |
| Italy | 81.2 | 211.9 | 279.3 | 324.0 | 373.7 | 465.4 |
| United Kingdom | 199.0 | 263.0 | 294.0 | 361.0 | 402.7 | 471.3 |
| **2. Urban and intercity bus** | | | | | | |
| Canada | 6.2 | 7.2 | 8.4 | 10.4 | 10.5 | 10.5 |
| United States | 74.2 | 71.8 | 72.3 | 80.1 | 74.1 | 73.2 |
| Japan | 83.9 | 100.8 | 98.7 | 108.8 | 102.0 | 109.0 |
| France | 25.3 | 25.2 | 28.9 | 38.0 | 37.0 | 43.2 |
| West Germany | 39.4 | 48.6 | 58.7 | 65.6 | 54.0 | 52.2 |
| Italy | 28.6 | 32.5 | 42.8 | 58.2 | 66.7 | 77.2 |
| United Kingdom | 59.0 | 53.0 | 55.0 | 45.0 | 42.0 | 41.0 |
| **3. Intercity and commuter rail** | | | | | | |
| Canada | 4.3 | 3.7 | 2.9 | 3.3 | 3.0 | 3.2 |
| United States | 28.3 | 17.5 | 16.3 | 17.7 | 18.2 | 20.3 |
| Japan | 258.7 | 290.0 | 319.6 | 316.2 | 334.7 | 368.8 |
| France | 38.3 | 41.0 | 50.7 | 54.7 | 62.1 | 63.3 |
| West Germany | 39.7 | 38.5 | 38.6 | 40.5 | 42.7 | 41.0 |
| Italy | 26.5 | 32.5 | 36.3 | 39.6 | 37.4 | 43.3 |
| United Kingdom | 30.1 | 30.4 | 30.3 | 30.3 | 29.7 | 34.3 |
| **4. Air (domestic scheduled services)** | | | | | | |
| Canada | 4.2 | 8.0 | 13.9 | 19.9 | 18.7 | 22.2 |
| United States | 93.6 | 171.8 | 218.6 | 326.4 | 424.3 | 521.3 |
| Japan | 3.6 | 8.4 | 18.0 | 29.0 | 32.8 | 39.5 |
| France | 0.8 | 2.6 | 6.0 | 8.2 | 11.3 | 15.8 |
| West Germany | 0.4 | 1.1 | 1.6 | 2.1 | 2.4 | 2.8 |
| Italy | 0.6 | 1.4 | 2.2 | 2.9 | 4.7 | 5.3 |
| United Kingdom | 1.8 | 2.1 | 2.1 | 2.7 | 3.4 | 4.4 |
| **5. Total** | | | | | | |
| Canada | 212.9 | 272.8 | 326.1 | 371.5 | 342.9 | 378.7 |
| United States | 2,815.3 | 3,469.7 | 3,888.6 | 4,253.1 | 4,745.9 | 5,215.4 |
| Japan | 400.9 | 610.9 | 700.7 | 782.2 | 867.6 | 1,073.3 |
| France | 262.4 | 373.5 | 460.4 | 553.3 | 604.8 | 676.6 |
| West Germany | 341.9 | 437.8 | 502.1 | 574.7 | 574.9 | 647.5 |
| Italy | 136.9 | 278.3 | 360.6 | 424.7 | 482.5 | 591.3 |
| United Kingdom | 289.9 | 348.5 | 381.4 | 439.0 | 477.8 | 551.0 |

**Royal Commission staff calculations based on data from Statistics Canada, the European Conference of Ministers of Transport (ECMT), and a number of U.S. and Japanese sources; see text.**

Table 2(2)-11

## MODAL SHARES OF TOTAL DOMESTIC PASSENGER TRAVEL IN PASSENGER-KILOMETRES, SELECTED COUNTRIES, 1965–1988

(PERCENT)

| Year | 1965 | 1970 | 1975 | 1980 | 1985 | 1988 |
|---|---|---|---|---|---|---|
| **1. Car (autos, light trucks, and vans)** | | | | | | |
| Canada | 93 | 93 | 92 | 91 | 91 | 90 |
| United States | 93 | 92 | 92 | 90 | 89 | 88 |
| Japan | 14 | 35 | 38 | 42 | 46 | 52 |
| France | 75 | 82 | 81 | 82 | 82 | 82 |
| West Germany | 77 | 80 | 80 | 81 | 83 | 85 |
| Italy | 59 | 76 | 77 | 76 | 77 | 79 |
| United Kingdom | 69 | 75 | 77 | 82 | 84 | 86 |
| **2. Intercity bus and urban transit** | | | | | | |
| Canada | 3 | 3 | 3 | 3 | 3 | 3 |
| United States | 3 | 2 | 2 | 2 | 2 | 1 |
| Japan | 21 | 17 | 14 | 14 | 12 | 10 |
| France | 10 | 7 | 6 | 7 | 6 | 6 |
| West Germany | 12 | 11 | 12 | 11 | 9 | 8 |
| Italy | 21 | 12 | 12 | 14 | 14 | 13 |
| United Kingdom | 20 | 15 | 14 | 10 | 9 | 7 |
| **3. Intercity and commuter rail** | | | | | | |
| Canada | 2 | 1 | 1 | 1 | 1 | 1 |
| United States | 1 | 1 | ** | ** | ** | ** |
| Japan | 65 | 47 | 46 | 40 | 39 | 34 |
| France | 15 | 11 | 11 | 10 | 10 | 9 |
| West Germany | 12 | 9 | 8 | 7 | 7 | 6 |
| Italy | 19 | 12 | 10 | 9 | 8 | 7 |
| United Kingdom | 10 | 9 | 8 | 7 | 6 | 6 |
| **4. Air (domestic scheduled services)** | | | | | | |
| Canada | 2 | 3 | 4 | 5 | 5 | 6 |
| United States | 3 | 5 | 6 | 8 | 9 | 10 |
| Japan | 1 | 1 | 3 | 4 | 4 | 4 |
| France | ** | 1 | 1 | 1 | 2 | 2 |
| West Germany | ** | ** | ** | ** | ** | ** |
| Italy | ** | 1 | 1 | 1 | 1 | 1 |
| United Kingdom | 1 | 1 | 1 | 1 | 1 | 1 |

**Source:** **Table 2(2)-10.**

** **indicates a share of less than 0.5%.**

*Table 2(2)-12*

### DOMESTIC TRAVEL BY MODE, PER CAPITA, 1965–1988

(THOUSANDS OF PASSENGER-KILOMETRES PER CAPITA)

| **Year** | **1965** | **1970** | **1975** | **1980** | **1985** | **1988** |
|---|---|---|---|---|---|---|
| **1. Car (autos, light trucks, and vans)** | | | | | | |
| Canada | 10.1 | 11.9 | 13.3 | 14.1 | 12.3 | 13.2 |
| United States | 13.5 | 15.6 | 16.6 | 16.8 | 17.7 | 18.8 |
| Japan | 0.6 | 2.0 | 2.4 | 2.8 | 3.3 | 4.5 |
| France | 4.1 | 6.0 | 7.1 | 8.4 | 9.0 | 9.9 |
| West Germany | 4.5 | 5.8 | 6.5 | 7.6 | 7.8 | 9.0 |
| Italy | 1.6 | 3.9 | 5.0 | 5.7 | 6.5 | 8.1 |
| United Kingdom | 3.7 | 4.7 | 5.3 | 6.4 | 7.1 | 8.3 |
| **2. Urban and intercity bus** | | | | | | |
| Canada | 0.32 | 0.34 | 0.37 | 0.43 | 0.42 | 0.40 |
| United States | 0.38 | 0.35 | 0.33 | 0.35 | 0.31 | 0.30 |
| Japan | 0.85 | 0.97 | 0.88 | 0.93 | 0.84 | 0.89 |
| France | 0.52 | 0.50 | 0.55 | 0.71 | 0.67 | 0.77 |
| West Germany | 0.67 | 0.80 | 0.95 | 1.07 | 0.88 | 0.87 |
| Italy | 0.55 | 0.60 | 0.77 | 1.03 | 1.17 | 1.34 |
| United Kingdom | 1.09 | 0.96 | 0.98 | 0.80 | 0.74 | 0.72 |
| **3. Intercity and commuter rail** | | | | | | |
| Canada | 0.22 | 0.17 | 0.13 | 0.14 | 0.12 | 0.12 |
| United States | 0.15 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 |
| Japan | 2.63 | 2.80 | 2.85 | 2.70 | 2.77 | 3.00 |
| France | 0.79 | 0.81 | 0.96 | 1.01 | 1.13 | 1.13 |
| West Germany | 0.68 | 0.63 | 0.62 | 0.66 | 0.70 | 0.67 |
| Italy | 0.51 | 0.60 | 0.65 | 0.70 | 0.65 | 0.75 |
| United Kingdom | 0.56 | 0.55 | 0.54 | 0.54 | 0.52 | 0.60 |
| **4. Air (domestic scheduled services)** | | | | | | |
| Canada | 0.21 | 0.38 | 0.61 | 0.83 | 0.74 | 0.86 |
| United States | 0.48 | 0.84 | 1.01 | 1.43 | 1.78 | 2.13 |
| Japan | 0.04 | 0.08 | 0.16 | 0.25 | 0.27 | 0.32 |
| France | 0.02 | 0.05 | 0.11 | 0.15 | 0.21 | 0.28 |
| West Germany | 0.01 | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 |
| Italy | 0.01 | 0.03 | 0.04 | 0.05 | 0.08 | 0.09 |
| United Kingdom | 0.03 | 0.04 | 0.04 | 0.05 | 0.06 | 0.08 |
| **5. Total** | | | | | | |
| Canada | 10.8 | 12.8 | 14.4 | 15.4 | 13.6 | 14.6 |
| United States | 14.5 | 16.9 | 18.0 | 18.7 | 19.9 | 21.3 |
| Japan | 4.1 | 5.9 | 6.3 | 6.7 | 7.2 | 8.7 |
| France | 5.4 | 7.4 | 8.7 | 10.3 | 11.0 | 12.1 |
| West Germany | 5.8 | 7.2 | 8.1 | 9.3 | 9.4 | 10.5 |
| Italy | 2.6 | 5.2 | 6.5 | 7.5 | 8.4 | 10.3 |
| United Kingdom | 5.3 | 6.3 | 6.8 | 7.8 | 8.4 | 9.7 |

*Table 2(2)-12 (cont'd)*

**Domestic Travel by Mode, Per Capita, 1965–1988**

*(THOUSANDS OF PASSENGER-KILOMETRES PER CAPITA)*

| Year | 1965 | 1970 | 1975 | 1980 | 1985 | 1988 |
|---|---|---|---|---|---|---|
| **Population (thousands)** | | | | | | |
| Canada | 19,644 | 21,297 | 22,697 | 24,043 | 25,165 | 25,909 |
| United States | 194,303 | 205,052 | 215,973 | 227,722 | 238,492 | 245,057 |
| Japan | 98,275 | 103,720 | 111,940 | 117,060 | 121,049 | 122,783 |
| France | 48,758 | 50,772 | 52,705 | 53,880 | 55,170 | 55,884 |
| West Germany | 58,619 | 60,651 | 61,829 | 61,566 | 61,024 | 61,418 |
| Italy | 51,987 | 53,661 | 55,830 | 56,434 | 57,141 | 57,452 |
| United Kingdom | 54,218 | 55,421 | 55,901 | 56,330 | 56,618 | 57,065 |

**Source: Table 2(2)-10.**

Estimated car travel per capita is substantially higher in the United States than in Canada (18,800 pass-km as compared with 13,200 pass-km, in 1988). However, per capita travel by all means in the United States exceeds per capita travel in Canada by an even larger proportional amount; thus the share of car travel in Canada is slightly higher than in the United States in recent years (90% versus 88%, in 1988). While the error range in the car figures is such that one cannot be certain that the Canadian car share really is slightly larger, it seems likely that this is the case. This is the counterpart of the fact that the U.S. domestic air travel share is clearly very much larger than in Canada.

As noted in Chapter 2, Volume 1, the car share in the western European countries is now approaching the share in North America, but the dominant position of the car is much more recent in western Europe. Japan has the smallest car share, but it is growing rapidly and surpassed rail in the 1980s.

*Bus*

The larger share of bus in Canada than in the United States appears to be due mainly to a larger share of urban bus travel. Intercity bus travel is estimated to account for 0.9% of total domestic travel in

Canada compared with 0.7% in the United States in 1988. (Estimated intercity bus passenger-kilometres per capita are actually slightly higher in the United States (150 pass-km) than in Canada (135 pass-km), although this difference is probably within the error margins of the estimates.) However, using similar bus occupancy assumptions for the two countries, the estimated share of urban bus passenger-kilometres in total travel for Canada is more than twice the share for the United States (1.9% versus 0.7%), and per capita urban bus passenger-kilometres are about 75% higher (270 pass-km versus 150 pass-km). There is reason to believe that Canadian urban bus average occupancy ratio may be substantially higher than U.S. occupancy.[4] If this is the case, the Canadian bus share could be one percentage point or more higher, and of course the contrast with the United States would be even more striking.

Inclusion of estimates of passenger-kilometres for subway and light rail system travel in the urban transit estimates does not change the conclusion that there is much greater use of urban transit in Canada than in the United States. Again, in the absence of official estimates of occupancy rates (or of passenger-kilometres) for Canada, occupancy rates in Canada equal to those implied in U.S. passenger-kilometre data are assumed and applied to Canadian subway and light rail vehicle-kilometre data (Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215). This yields an estimate of 3.7 billion pass-km of subway/light rail travel for Canada, or roughly half the urban bus passenger-kilometre estimate of 7 billion in 1988. In the United States, subway and light rail passenger-kilometres of 18.9 billion are also equal to roughly half the 36 billion U.S. urban bus passenger-kilometres.

In the United Kingdom, subway and light rail passenger-kilometres are estimated to equal 16% of total bus passenger-kilometres, or 1.2% of total domestic passenger-kilometres (U.K. Department of Transport, *Transport Statistics Great Britain 1979–1989*, London, HMSO, 1990). If this figure is typical of the other western European countries, it suggests that exclusion of subway and light rail urban transit from the tables, while a significant omission in terms of covering the role of urban public transit, does not result in any very significant distortion of the estimated share of the car in total domestic travel.

### *Train*

While train travel has decreased substantially as a share of total travel in all the countries considered, there are also major differences in its role among the countries. Whether considered in terms of share, or in passenger-kilometres per capita, train is clearly much more important in Japan than in the other countries. It is somewhat more important in France than in West Germany, Italy or the United Kingdom. In turn, train travel is several times as important in these west European countries as in Canada and, in 1988, was 50% higher — in passenger-kilometres per capita — in Canada than in the United States. Commuter rail accounts for somewhat more than half of the U.S. rail passenger-kilometres in these estimates (45 pass-km compared with 37 pass-km for intercity rail in 1988). In 1988, commuter rail passenger-kilometres in Canada were 22 per capita, while after the VIA Rail cuts intercity rail in Canada is estimated to be 52 passenger-kilometres per capita.

### *Air*

The differences among countries in air travel's share of total domestic travel appear to reflect, most importantly, differences in geography — with air travel having higher shares in the less compact countries. Including international air travel provides a useful additional perspective on the role of air. Table 2(2)-13 repeats, for 1988, the estimates of domestic scheduled air passenger-kilometres in total and in per capita terms, and the domestic modal shares from Tables 2(2)-10 to 2(2)-12. It also shows ICAO data on international air travel, both scheduled and non-scheduled ("charter"), and the sum of domestic and international air travel. The international air travel passenger-kilometres are added to total domestic passenger-kilometres for all modes to produce an "alternative" measure of total travel. Finally, modal shares are shown using the same passenger-kilometre estimates as in the earlier tables for car, bus and train, the sum of domestic and international travel for air, and expressing the modal figures as percentages of the alternative measure of total travel (including air).

*Table 2(2)-13*

*IMPACT OF INCLUDING INTERNATIONAL AIR TRAVEL WITH DOMESTIC TRAVEL, 1988*

| | Canada | U.S. | Japan | France | Germany | Italy | U.K. |
|---|---|---|---|---|---|---|---|
| **Air travel (billions of passenger-kilometres)** | | | | | | | |
| Domestic scheduled (Table 2(2)-11) | 22.2 | 521.3 | 39.5 | 15.8 | 2.8 | 5.3 | 4.4 |
| International scheduled | 24.0 | 153.3 | 44.6 | 32.0 | 31.3 | 13.9 | 78.6 |
| International non-scheduled | 8.1 | 8.1 | 0.3 | 0.2 | 0.1 | 0.8 | 34.5 |
| **Total air travel** | **54.4** | **682.7** | **84.4** | **48.0** | **34.2** | **19.9** | **117.6** |
| Total domestic travel (Table 2(2)-11) | 378.2 | 5,215.4 | 1,073.3 | 676.6 | 647.5 | 591.3 | 551.0 |
| Alternative total travel[a] | 410.4 | 5,376.8 | 1,118.2 | 708.8 | 678.8 | 605.9 | 664.2 |
| **Air travel per capita (thousands of pass-km per person)** | | | | | | | |
| Domestic scheduled (Table 2(2)-11) | 0.86 | 2.13 | 0.32 | 0.28 | 0.05 | 0.09 | 0.08 |
| International scheduled | 0.93 | 0.63 | 0.36 | 0.57 | 0.51 | 0.24 | 1.38 |
| International non-scheduled | 0.31 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.61 |
| **Total air travel** | **2.10** | **2.79** | **0.69** | **0.86** | **0.56** | **0.35** | **2.06** |
| Total domestic travel (Table 2(2)-11) | 14.6 | 21.3 | 8.7 | 12.1 | 10.5 | 10.3 | 9.7 |
| Alternative total travel[a] | 15.8 | 21.9 | 9.1 | 12.7 | 11.1 | 10.5 | 11.6 |
| **Shares of Total Travel (percent)** | | | | | | | |
| Excluding international air (Table 2(2)-11) | | | | | | | |
| Car | 90 | 88 | 52 | 82 | 85 | 79 | 86 |
| Bus | 3 | 1 | 10 | 6 | 8 | 13 | 7 |
| Rail | 1 | ** | 34 | 9 | 6 | 7 | 6 |
| Air | 6 | 10 | 4 | 2 | ** | 1 | 1 |
| Including international air | | | | | | | |
| Car | 83 | 86 | 50 | 78 | 81 | 77 | 71 |
| Bus | 3 | 1 | 10 | 6 | 8 | 13 | 6 |
| Rail | 1 | ** | 33 | 9 | 6 | 7 | 5 |
| Air | 13 | 13 | 8 | 7 | 5 | 3 | 18 |

**Sources: Tables 2(2)-10 to 2(2)-12 and ICAO data.**

** **indicates a share of less than 0.5%.**

a. **domestic for all modes plus international air.**

The international air travel data are not for travel by residents of the countries in question, but rather are for international travel provided by carriers that are resident in the country in question. These data only provide a reasonable approximation of international air travel by residents of the country if international air travel services provided to residents by foreign carriers approximately equal international air travel services provided to non-residents by carriers of the country. For most of the countries shown, net exports or imports of passenger air services are believed to be relatively small compared with total international air travel by residents. It may be the case, however, that net exports of air services result in the figure for the United Kingdom giving a somewhat exaggerated impression of international air travel by U.K. residents, and that net imports of air services result in the figure for Italy being an underestimate of international air travel by residents of Italy. Nevertheless, for the countries shown, the estimates of international air travel provided by carriers of the country give an approximate impression of international air travel by residents of the country.

The United States has, by a substantial margin, the highest levels of domestic air travel in terms of passenger-kilometres per capita and in terms of percentage share of total domestic travel. But in per capita terms it has a lower level of international air travel than the United Kingdom or Canada, and a similar level to France and West Germany. The United States has the highest level of total air travel per capita, but Canada and the United Kingdom are not too far behind.

Inclusion of international air travel in total travel of course reduces the shares of all the other modes. Whereas, when only domestic travel was considered (Table 2(2)-11), car travel was estimated to account for a slightly larger share of total travel in Canada than in the United States; car accounts for a somewhat smaller share of total travel in Canada than in the United States if international air travel is included in the total.

## 4. IMPORTANCE OF LONG AND SHORT TRIPS IN DOMESTIC INTERCITY TRAVEL

Chart 2-2 in Chapter 2, Volume 1, shows the number of trips in Canada in 1990 by categories of one-way distance from 80–159 kilometres to over 1,600 kilometres, as reported in the Canadian Travel Survey (CTS). Chapter 2 mentions that, in 1990, 76% of intercity trips taken were between 80 and 320 kilometres in one-way distance, but also notes that trips over 320 kilometres in one-way distance accounted for more than 60% of intercity passenger-kilometres travelled.

This brief note provides estimates that compare the shares in number of trips, and in passenger-kilometres, for trips in the different length categories (Table 2(2)-14). Both the shares of trips, and the shares of passenger-kilometres, are based on Canadian Travel Survey data for 1990. Calculation of the shares of passenger-kilometres requires use of unpublished data from the survey on average trip length in the different length categories. Estimates of both types of share are of course subject to the limitations of the CTS data discussed in Section 1 of these notes; in particular it is quite possible that recall problems by respondents result in some relative underestimation of shorter trips.

The total number of trips, and total passenger-kilometres of travel, are consistent with the numbers reported in the "CTS-based" estimates in Table 2(2)-1, allowing for the fact that Table 2(2)-1 counts one-way trips while Table 2(2)-14 (and Chart 2-2) count round trips, and for the fact that Table 2(2)-1 excludes trips by means other than car, air, bus, rail and ferries.

Longer trips of course account for a much larger share of total passenger-kilometres than of numbers of trips. In particular, trips over 800 kilometres in one-way distance account for 39.2% of passenger-kilometres but only 6.3% of total trips, and trips over 1,600 kilometres in one-way distance account for 26.5% of passenger-kilometres of intercity travel but only 2.6% of the number of trips.

*Table 2(2)-14*

### DOMESTIC INTERCITY TRAVEL BY LENGTH OF TRIP, 1990

*(SHARES IN NUMBER OF PERSON-TRIPS AND IN PASSENGER-KILOMETRES OF TRAVEL)*

| | Person-trips | | Average round-trip distance (km) | Passenger-kilometres | |
|---|---|---|---|---|---|
| | ('000s) | (%) | | (millions) | (%) |
| **Trips — one-way distance** | | | | | |
| 80–159 km | 62,278 | 46.5 | 219 | 13,650 | 16.8 |
| 160–319 km | 39,587 | 29.6 | 427 | 16,897 | 20.8 |
| 320–799 km | 20,420 | 15.3 | 930 | 18,984 | 23.3 |
| 800–1,599 km | 4,954 | 3.7 | 2,079 | 10,297 | 12.7 |
| 1,600–3,199 km | 2,192 | 1.6 | 4,299 | 9,424 | 11.6 |
| 3,200 km or more | 1,401 | 1.0 | 8,656 | 12,127 | 14.9 |
| Not stated | 2,999 | 2.2 | | | |
| Total | 133,831 | 100.0 | 608 | 81,375 | 100.0 |

**Source:** Statistics Canada, *Touriscope: Domestic Travel 1990*, Catalogue No. 87-504, October 1991, p. 27, and unpublished Canadian Travel Survey data.

**Note:** Component percentage shares may not sum exactly to 100% due to rounding.

# ENDNOTES

1. The occupancy rate is based on information from D. Ward's *Profile of the Intercity Bus Industry* (Transport Canada, May 1990), p. 5, and material provided to the Royal Commission by several large intercity bus firms. Ward judges typical occupancies to be about 18 passengers per bus in Canada, but, based on the occupancies recorded by the large firms, we judge that a somewhat higher assumption is appropriate. In our estimate, the system average number of passengers has been assumed to be 21, which is an occupancy rate of 50% or an average of 42 seats per bus.

2. Derived from Dennis Ward, "The Cruise Industry," Transport Canada, TP9163, April 1988. The estimate in this source of 157,000 passengers for 1987 is extrapolated forward at a 4% annual growth rate, and an allowance of 20,000 for inland waters cruise passengers is added.

3. Gordon D. Campbell, "An Analysis of Highway Finance and Road User Imposts in Canada," (Ph.D. thesis, Purdue University, Lafayette, Indiana, 1956).

4. Personal communication with officials of the Canadian Urban Transit Association.

# ANNEX 1

## CAR TRAVEL — TOTAL AND HIGHWAY

No direct data on total vehicle-kilometres or passenger-kilometres of travel by car exist, but approximate estimates of vehicle-kilometres may be derived in two ways:

- using statistics on sales of gasoline for road use coupled with estimates of average fuel consumption per kilometre; or
- using statistics on the total stock of passenger motor vehicles coupled with estimates of average annual distance travelled per vehicle.

Using both approaches, this Annex first develops estimates of vehicle-kilometres of travel for both "passenger automobiles" and for "light trucks" (four-wheel vehicles, other than passenger automobiles, under 4,500 kg in laden weight, such as, pickups, minivans and 4-wheel drive vehicles) used for passenger transport. Separate data on the amount of travel on provincial highways by these classes of vehicle are then considered. Finally, assumptions as to the number of occupants per vehicle are introduced in order to arrive at rough estimates of the number of passenger-kilometres of travel by car in total and on highways.

### A1.1 TOTAL TRAVEL — VEHICLE-KILOMETRES

**Gasoline Sales Plus Fuel Economy**

Sales of gasoline taxed for use in road motor vehicles totalled 31.8 billion litres in 1990 (Statistics Canada, *Road Motor Vehicles — Fuel Sales, 1990*, Catalogue No. 53-218). Unpublished National Energy Board studies for the mid-1980s suggest that 65% of sales are for passenger automobiles, with the remainder being consumed in other vehicles, such as light trucks, non-diesel heavier trucks and buses, and motorcycles. Fragmentary evidence suggests that about 80% of this remaining 35% of sales, or 8.9 billion litres, is for light trucks.

Statistics Canada's *Fuel Consumption Survey*, Catalogue No. 53-226, which was last conducted for 1988, provides what are believed to be quite reliable estimates of average fuel economy for passenger automobiles and light trucks for the period covered by the survey. These estimates are 12.0 litres per 100 kilometres for passenger automobiles in 1988, and 16.6 litres per 100 km for light trucks in 1987. While there may have been some improvement in average fuel economy since 1988, these estimates are used. Applied to the gasoline sales estimates, they suggest total travel in 1990 of 172.5 billion vehicle-kilometres for passenger automobiles, and 55 billion vehicle-kilometres for light trucks.

### Stock of Cars Plus Average Annual Use

Personal-use passenger automobiles sampled by the Fuel Consumption Survey were driven an average of 17,400 kilometres in 1988, while light trucks were driven an average of 18,200 kilometres. The stock of vehicles to which these average distances should be applied is less than the figures appearing in Statistics Canada's *Road Motor Vehicles — Registrations* (Catalogue No. 53-219). During sampling for the fuel consumption surveys it was found, for 1983, that about 8% of registered passenger automobiles had been scrapped, 2% of registrations were duplications, and another 10% were in existence and operable but out of service in dealers' hands, in storage or under repair.[1] Passenger automobile registrations for 1990 were 12.6 million. Applying the estimate of average annual kilometres driven (17,400 for passenger automobiles) to 80% of the registrations level (or 10.1 million vehicles) suggests 175.6 billion vehicle-kilometres of travel by passenger automobiles in 1990, compared with the estimate of 172.5 billion vehicle-kilometres derived using gasoline sales. A rounded estimate of 175 billion vehicle-kilometres of travel for 1990 is used.

Motor vehicle registration figures are believed to include most light trucks, as defined earlier, in the "trucks" sub-category of "commercial vehicles." There were 3.9 million "trucks" registered in 1990, of which 500,000 are estimated to be heavy trucks,[2] suggesting 3,400,000 light trucks. Assuming that, as for passenger automobiles, the number of light trucks in use is only about 80% of the number of light truck registrations, suggests that the 18,200 average annual kilometres of use figures should be applied to about 2,700,000 light trucks in use, yielding an estimate of 49 billion vehicle-kilometres. This compares with the estimate of 55 billion vehicle-kilometres derived using fuel sales data. A rounded estimate of 50 billion vehicle-kilometres for 1990 is used. Further, it is assumed that 80% of this amount, or 40 billion vehicle-kilometres, were for private passenger transport, with the remainder for freight use.

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[1] E. Lawrence, *Fuel Consumption Data Book*, Technical Memorandum TMSE 9102, Transport Canada, March 1991, pp. 111-15.

## A1.2 HIGHWAY TRAVEL — VEHICLE-KILOMETRES

The estimates are based on the study for the Royal Commission by Nix, Boucher and Hutchinson in Volume 4 of this Report, which uses provincial highway traffic count data. With the modification discussed in Notes to Chapter 3, subsection 5.1.1 of this Volume, it is estimated that travel on provincial highways by passenger automobiles was about 97.5 billion vehicle-kilometres in 1990 and 100 billion vehicle-kilometres in 1991. Travel by light trucks in use for passenger transportation purposes is estimated to be 19 billion vehicle-kilometres in 1990 and 20 billion in 1991.

## A1.3 PASSENGER-KILOMETRES OF TRAVEL

There is very little information on the average number of occupants per passenger automobile or light truck overall or in different types of use. Estimates for the United States from the Nationwide Personal Transportation Survey (NPTS) indicate an overall occupancy rate of 1.5 for 1990, with average occupancy ranging from 1.1 for work trips, through 1.5 for shopping trips, 1.7 for other family/personal trips, to 1.8 for social/recreational trips. Canadian vehicle ownership per capita or per household is somewhat lower than in the United States, and it is reasonable to assume that average occupancy is somewhat higher. Average occupancies for passenger automobiles of 1.8 persons in highway driving, and 1.5 persons in other (primarily urban) driving, are assumed. For light trucks, given the predominance of pickup trucks with fewer seats than cars, average highway occupancy of 1.5 persons and average other occupancy of 1.2 are assumed.

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[2] See Appendix A of Fred P. Nix, Michel Boucher and Bruce Hutchinson, "Road Costs," in Volume 4 of this Report.

These occupancy assumptions, when combined with the vehicle-kilometre estimates, yield the estimates of passenger-kilometres of highway and total travel in 1990 shown in Table 2(2)-A1.

*Table 2(2)-A1*

*ESTIMATES OF VEHICLE- AND PASSENGER-KILOMETRES: CAR, 1990*

| | Veh-km (billion) | Pass-km (billion) |
|---|---|---|
| **Passenger automobile** | | |
| Highway | 97.5 | 176 |
| Other | 77.5 | 116 |
| Total | 175 | 292 |
| **Light truck in passenger transportation use** | | |
| Highway | 19 | 29 |
| Other | 21 | 25 |
| Total | 40 | 54 |
| **Both ("car")** | | |
| Highway | 116.5 | 205 |
| Other | 98.5 | 141 |
| Total | 215 | 346 |

These estimates are used as the basis for a number of other estimates in Sections 1, 2 and 3 of the Notes to Chapter 2. In Section 1, two thirds of the highway total of 205 billion passenger-kilometres, or a rounded 135 billion passenger-kilometres, is used as a rough estimate of intercity car travel. In Chapter 3 of Volume 1, 210 billion passenger-kilometres is shown as the estimate of total passenger-kilometres of car highway travel for 1991. In Section 3, the 346 billion estimate of total car travel for 1990 (rounded to 350 billion) is used in calculating the 1988 Canadian figure for the international comparison of total travel by the different means of transportation.

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## INTRODUCTION

Chapter 3 presents estimates of Canadian (average and total) domestic intercity passenger modal costs and average modal costs for four illustrative routes. Chapter 18 includes projections of system total and illustrative route-specific average costs to the year 2000.

These modal estimates encompass:

- infrastructure;
- environmental costs;
- accident costs;
- transportation taxes and fees; and
- vehicle and carrier operations.

The cost estimates are split into the portion of the cost paid by the users or travellers and the portion of average cost paid by the taxpayer, by other travellers on other routes and by society in other than financial terms, for example, through suffering the effects of pollution.

## 1. UNDERSTANDING THE TABLES

The tables in Volume 1, Chapters 3 and 18 are intended to portray the costs of domestic passenger transportation in Canada including environmental and accident "costs," currently borne by the public, and the cost and financial implications, to users and taxpayers, of the Royal Commission's recommendations. Table 3(2)-1 reproduces the illustrative system-average costs from Table 3-1 of Volume 1.

To help the reader understand what the estimates in Table 3(2)-1 cover, Table 3(2)-2 provides a hypothetical expansion of the portion of a table showing results for a particular means of travel. This table could illustrate average costs per passenger-kilometre, total costs in millions of dollars, or current and projected costs per trip on a specific route. It could apply to the 1991 cost estimates of Volume 1, Chapter 3 or it could apply to the scenario projections of Volume 1, Chapter 18. The numbers used have no significance; they are intended purely to help explain the meaning of the table components.

*Table 3(2)-1*

### Illustrative System-Wide Average Annual Costs of Intercity Domestic Travel (Cents per passenger-kilometre)

| | Car | | | Bus | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 2.1 | 2.1 | 0.0 | 0.3 | 0.3 |
| **Environmental** | 0.0 | 0.6 | 0.6 | 0.0 | 0.2 | 0.2 |
| **Accident** | 3.7 | 0.1 | 3.8 | 0.4 | 0.0 | 0.4 |
| **Special trans. tax/fee** | 1.2 | −1.2 | 0.0 | 0.3 | −0.3 | 0.0 |
| **Vehicle/Carrier** | 10.9 | 0.0 | 10.9 | 8.4 | 0.2 | 8.6 |
| **Total** | **15.8** | **1.6** | **17.4** | **9.1** | **0.4** | **9.5** |

| | Airplane | | | Train | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 2.2 | 3.4 | 5.6 | 2.9 | 0.0 | 2.9 |
| **Environmental** | 0.0 | 1.0 | 1.0 | 0.0 | 0.6 | 0.6 |
| **Accident** | 0.1 | 0.0 | 0.1 | 0.2 | 0.0 | 0.2 |
| **Special trans. tax/fee** | 0.6 | −0.6 | 0.0 | 0.4 | −0.4 | 0.0 |
| **Vehicle/Carrier** | 14.4 | 0.0 | 14.4 | 7.4 | 32.8 | 40.2 |
| **Total** | **17.3** | **3.8** | **21.1** | **10.9** | **33.0** | **43.9** |

| | Ferry | | | All intercity travel | | |
|---|---|---|---|---|---|---|
| **Type of cost** | **Users** | **Others** | **Total** | **Users** | **Others** | **Total** |
| **Infrastructure** | 0.0 | 4.7 | 4.7 | 0.2 | 2.2 | 2.4 |
| **Environmental** | 0.0 | 2.0 | 2.0 | 0.0 | 0.6 | 0.6 |
| **Accident** | 0.1 | 0.0 | 0.1 | 3.3 | 0.1 | 3.4 |
| **Special trans. tax/fee** | 0.9 | −0.9 | 0.0 | 1.1 | −1.1 | 0.0 |
| **Vehicle/Carrier** | 24.1 | 11.6 | 35.7 | 11.2 | 0.2 | 11.4 |
| **Total** | **25.1** | **17.4** | **42.5** | **15.8** | **2.0** | **17.8** |

**Note:** **In order to illustrate smaller components, averages are shown to the nearest tenth of a cent. In general, cost estimates are approximate and are not accurate to this level of precision. See text.**

*Table 3(2)-2*

COST TABLES ILLUSTRATION: HYPOTHETICAL EXAMPLE
(DOLLARS)

| | Costs borne by: | | | | | Total costs |
|---|---|---|---|---|---|---|
| | | Others | | | | |
| | | | Government | | | |
| **Type of Cost** | **Users** | **Travellers** | **Federal** | **Provincial** | **Public** | |
| **Infrastructure** | | | | | | |
| Links | 25 | | –6 | | | 19 |
| Terminals | 15 | | 3 | | | 18 |
| Control | | | 2 | | | 2 |
| **Environmental** | | | | | 24 | 24 |
| **Accident** | 4 | | | 1 | | 5 |
| **Special trans. tax/fee** | | | | | | |
| Fuel taxes | 16 | | –9 | –7 | | 0 |
| Licence fees | 1 | | –1 | | | 0 |
| **Vehicle/Carrier** | 333 | –35 | | 3 | | 301 |
| **Total** | **394** | **–35** | **–11** | **–3** | **24** | **369** |

The key element of the sample expansion is the column "others," which identifies four categories of cost sustainers and funds providers or recipients: travellers, federal government, provincial government and the public. Also, the infrastructure row is subdivided in this example into links, terminals and control; and the special transportation tax/fee row, into fuel taxes and licence fees. Of course, other categories might apply.

Starting with infrastructure, in terms of airplane travel, the $25 shown for links in the users column could indicate a traveller payment of Air Transportation Tax. This exceeds, by $6, the $19 total cost of air navigation support paid by the federal government as shown in the total column. Thus, the $6 is shown as negative, being a net revenue gain to the federal government. For terminals, $15 in landing fees represents an under-recovery of airport costs by $3. In the column others/government/federal, the traffic control cost of $2 is shown as not recovered, by a specifically designated payment.

In the environmental row, a cost to the public of $24 is shown. This represents a valuation estimate of the physical effects of environmental damage experienced by members of the public. At present, no transactions related to these costs occur.

The treatment of accident costs is more interesting analytically. The traveller, through her or his fare via the carrier's insurance cost, is shown as paying $4 and the provincial government pays $1, in medicare. Were this means of travel a road vehicle, the accident cost imposed on the occupants of other vehicles and not fully compensated by the travellers and their insurance would be included under users. This is based on the view that incurring the risk of such costs is part of the "price" paid when one travels by road. An alternative approach would be to separate out accident costs to other travellers and include them as a further "others" sub-category.

Special transportation taxes and fees, from the point of view of others, are government revenues, and are represented by negative costs of $9 in fuel taxes and $1 in licence fees paid by the traveller to the federal government (actually paid by the carrier from the traveller's fare). The $7 under provincial fuel taxes, a negative cost to provincial governments, represents the traveller's share of this tax; this is an estimate of the amount that exceeds the provincial sales tax that applies generally.

The vehicle/carrier cost of $333 under users may be viewed as the balance (on average) of what a traveller pays toward his or her total fare that is attributable to cost items other than those represented in the rows above it in the matrix.

Viewing the other elements of the vehicle/carrier row, travellers are shown as receiving a $35 "cross subsidy,"[1] and the provincial government is shown as paying a subsidy of $3, presumably direct, toward vehicle/carrier costs.

The total row indicates that travellers pay an average fare of $394. Because the average total cost of the hypothetical trip is $369, the average traveller appears to pay $25 more than the costs concerned — if one does not subtract the $35 cross subsidy to other travellers. Although the federal and provincial governments have net financial gains of $11 and $3 respectively, this does not balance a $24 cost to the public for environmental damage.

As mentioned, Table 3(2)-1 and the tables of Chapters 3 and 18 use a more condensed format in which the "others" columns, the "infrastructure" and "special transportation tax/fee" rows are not subdivided. The expanded, illustrative table shows the possible components of a single entry in the condensed format.

## 2. COSTING BASIS

Among the modes, the consistency of costing basis was limited by the structure of the data available for each mode. With the exception of the car, and with it vans and light trucks, costing and cost estimates were confined to public unit toll travel. Private airplane and boat transportation were not included. Chartered aircraft (true charters where the aircraft is leased generally with crew, fuel and supplies — not low priced travel, with tickets, that may be advertised as charter), bus and boat travel were also excluded where the data allowed.

In the case of bus, this was an important exclusion. It is estimated that 2.6 billion bus passenger-kilometres[2] were on domestic-origin, non-urban, non-school chartered service. This compares with the estimated 3.3 billion passenger-kilometres for scheduled domestic intercity bus services, which are the subject of the cost and other bus references of Volume 1.

Where possible, the costs presented are for domestic origin and destination travel. In some cases the domestic portion of international trips have been included; for the automobile, rail and bus, all travel within Canada was included. For air, international flights that originate or terminate in Canada and overflights of Canadian airspace were excluded; however, it was not possible to exclude domestic flights (separate ticket coupon) that were part of what was essentially an international trip.

## 3. COSTING PRINCIPLES

In general, the analysis is intended to produce an estimate of long-run average costs for the industry. Thus, all costs, including those of head office, were attributed to services they presumably support. Unless there was evidence that joint costs were attributable to less than the total product mix, these costs (for example, for VIA Rail stations) were allocated or attributed to services primarily on the basis of volume of use.

The ways in which density, speed, stage or journey length affected costs were considered and incorporated in developing cost estimates for types of routes.

An opportunity-cost-of-capital rate of 10% real (10% plus inflation) was used for all operators and modes. This figure is recommended for use throughout the federal government[3] as a social discount rate, and, when adjusted for inflation, is very close to the cost-of-capital rate for CP as calculated by the National Transportation Agency.

Wherever practical, capital costs of equipment and infrastructure (depreciation and cost of capital) were treated on a current value basis.[4] For most equipment and infrastructure this amounted to replacement value costing. Essentially, depreciation and the 10% real cost of capital, applied to the replacement cost of the remaining capital investment, were taken as representative of the full opportunity cost of invested capital. Also included as a capital charge was the opportunity cost of capital invested in the land occupied by road, track, airport and port infrastructure wherever the magnitude of this cost was believed to be substantial — primarily airport property.

Applying a common rate of capital cost to estimates of the replacement value of the capital stock in use helps make cost estimates for the different modes comparable. In particular, these cost estimates are not affected by differences in the extent to which a given entity is debt financed or may have received what might be viewed as equity capital at no charge from governments.

## 4. DATA AND COST DEVELOPMENT

The system average or typical cost estimates that follow were developed from the data available, with gaps filled on the basis of engineering costing, essentially aggregating the costs of the inputs, and on quoted ticket prices.

Statistics Canada publications were the primary sources of data for the system-wide costs. For costing purposes, Statistics Canada provided special aggregations of data. Data were also obtained from provincial authorities; Transport Canada; the Transportation Association of Canada; Canadian air, bus, ferry and railway carriers; and published studies. The key source of data for the carrier costs on the illustrative routes provided in Volume 1 was the industry. The response of the airline, railway, ferry and bus companies to requests for detailed cost, revenue, traffic and market data was most gratifying. In some cases, however, data were provided on a confidential basis. Respecting this confidentiality limits the specificity or extent of detail that can be reported for some of the cost estimates.

Most of the costs were estimated for 1989 or the organizations' fiscal year 1989–90, but some 1990 and 1991 data were used, and in some cases it was necessary to use pre-1989 data. The estimates were adjusted approximately to 1991 cost and price levels.

Costs were intended to represent normal 1991 conditions, but many of the input data were, as has been noted, from other recent years. Where there were reasonable grounds to suggest changes that had occurred to 1991, such changes were incorporated, and all estimates were converted to 1991 prices.

The illustrative 1991 costs used are not an estimate of actual 1991 levels; 1991 was an unusual year with some major carriers suffering large losses. The 1991 year carried surprises and anomalies that are not expected to persist. An attempt was made to represent the longer-term trend. All costs are in 1991 prices, but essentially represent a "normal" recent year.

The system-average costs by mode in Chapter 3 were estimated in cents per passenger-kilometre (¢/pass-km). The estimates of total costs by mode for 1991 were obtained by multiplying these system-average costs by the Royal Commission's estimates of total passenger-kilometres in that year.

# 5. INFRASTRUCTURE COSTS

## 5.1 CAR

### 5.1.1 Costs of Highway Construction and Maintenance

Estimates are based on the report to the Royal Commission by Nix, Boucher and Hutchinson,[5] in Volume 4 of this report. The study estimates the total costs for deterioration and maintenance of the provincial paved highway system, based on estimates published by the Transportation Association of Canada as well as Canadian models of highway-lifecycle costs. The study's estimates, by necessity, are very approximate. This is due primarily to uncertainty in the causes and attribution of road wear, but also in part to uncertainty in the spending estimates. The absence in Canada of data on highway traffic by vehicle weights and axle configurations particularly contributes to these uncertainties.

An important unresolved technical question is the extent of interaction between pavement deterioration due to climate and deterioration due to wear. The report effectively assumes there is no such interaction, as do these notes.

It is possible that deterioration identified by Nix et al. as being separately caused by climatic conditions is in fact the joint result of climate and traffic, and that the traffic contribution is therefore underestimated. Research to date has not adequately explored this relationship, and it remains an important issue for research into the design of a correct cost attribution and pricing regime.

The tentative allocation of costs to vehicle classes in the Nix et al. report provides the basis for the estimates of infrastructure costs in Table 3(2)-1, but with two important modifications:

- Nix et al. allocated all common costs (including those parts of pavement deterioration dependent on climate rather than wear, common annual maintenance items, and administrative costs) according to vehicle-kilometres by vehicle class. Royal Commission staff calculations have instead allocated these costs according to vehicle-kilometres weighted by "passenger-car-equivalent" units (PCEs), with an average heavy truck representing 2.5 PCEs, and an average bus, 2 PCEs.
- The report estimated total traffic wear on the provincial highway systems as 158 billion vehicle-kilometres, about 43 billion of which was on the "middle 30%" of paved two-lane rural highways. This seems high based on the evidence presented (from counting vehicles using each class of highway in some provinces), and an annual average daily traffic (AADT) of 2,000 vehicles instead of 3,000 has been assumed for these highways, thereby reducing the estimate for this sub-network to about 28 billion vehicle-kilometres and the total for the provincial network to 144 billion vehicle-kilometres.

The resulting estimated costs by class of road are shown in Table 3(2)-3. While costs per route-kilometre to build highways to higher standards are greater, such highways tend to have high traffic volumes over which those costs are spread. Therefore, costs per passenger-kilometre are lower on the higher quality and higher traffic density highways.

*Table 3(2)-3*
*ESTIMATED CONSTRUCTION AND MAINTENANCE COSTS BY CLASS OF HIGHWAY*
*(1989 CENTS PER VEHICLE-KILOMETRE)*

| Road class | Annual average daily traffic (number of vehicles) | Costs by vehicle type | | |
|---|---|---|---|---|
| | | Car/ light truck | Heavy truck | Bus |
| Expressway | 12,000 | 0.47 | 2.62 | 1.06 |
| Other paved highways: | | | | |
| Densest 10% | 6,000 | 0.71 | 3.99 | 1.56 |
| Medium 30% | 2,000 | 1.77 | 9.79 | 3.71 |
| Least dense 60% | 700 | 4.77 | 21.38 | 9.77 |
| Average highway | — | 1.46 | 5.48 | 3.00 |
| Cents per pass-km | — | 0.83 | — | 0.14 |
| Cents per pass-km, in 1991 prices | — | 0.91 | — | 0.15 |

The costs as estimated are identical for cars and light trucks. The final two rows (in ¢/pass-km) for car and light truck costs represent averages combined in proportion to their passenger-kilometres, using the standard assumptions of average occupancies of 1.8 passengers per car and 1.5 passengers per light truck, giving a combined average of 1.76. The estimates of costs per passenger-kilometre for buses assume average occupancy of 45% of 47 seats, or 21.15 passengers per bus.

### 5.1.2 Cost of Highway Capital

While depreciation (pavement deterioration) is included in the estimates, the cost of capital for highway infrastructure must be added. The Royal Commission staff estimates of highway cost of capital are quite speculative. Very little information is available to allow estimation of the size of the highway capital stock. A study by Lall, in Volume 4 of this report,[6] updating earlier work for the Canadian Transport Commission and Transport Canada,[7] suggests the entire road network stock amounted to about $52 billion in 1988. Updated only by inflation, this would have amounted to about $59 billion in 1991. The proportion of this that is for intercity or extra-urban highways can only be guessed.

The paved provincial highway network to which the estimates of Nix et al. apply, consists of about 140,000 two-lane kilometres, of a total of 880,000, or 16%. This relatively small proportion, however, includes all of the costly provincial expressways[8] and highways through urban areas, and all paved rural highways, which are of higher quality and cost than unpaved provincial or municipal roads or than municipal streets. For illustrative purposes, it is guessed that the paved highways are 40% to 60% of the total capital stock; that is, $24 billion to $35 billion.

The amount of these costs that is attributable to car and light truck traffic must be estimated next. The allocation by PCEs attributes 59% of common highway costs to passenger cars, and 15% to light trucks. It is assumed that about 80% of light truck use is for passenger travel, so the total proportion of highway cost for cars and light trucks in passenger use is estimated at 70%. Applying the same proportion to the capital costs, the costs attributed to cars and light trucks would amount to $16 billion to $25 billion.

Then this cost must be converted to an annual amount. The assumption throughout these cost estimates has been that the appropriate (opportunity-cost) rate with which to calculate the annual cost attributable to capital investment is 10% per year. The highway cost of capital attributed to passenger cars would therefore amount to $1.6 billion to $2.4 billion.

Finally, the cost per passenger-kilometre can be estimated by averaging the annual capital cost over total travel of 210 billion passenger-kilometres. These very rough computations suggest the value is in the range of 0.8¢/pass-km to 1.12¢ pass-km. As this is of the same order of magnitude as the earlier estimate of the highway deterioration/maintenance cost per passenger-kilometre, and relies on such rough reasoning, the capital charge is incorporated by simply doubling the deterioration/maintenance cost for each class of vehicle and type of highway.[9]

In consequence, the cost for cars of road infrastructure is estimated as 0.91 × 2 = 1.82¢/pass-km.

### 5.1.3 Land Costs

A difficulty in allowing for land costs is that if they are included in the accounts of transport authorities at all, they are likely to be based on historical purchase prices, which do not adequately represent current values. More particularly, they do not represent the value the land would have if liberated for other use. This is essentially an argument that the appropriate value to include is the "opportunity cost," that is, the value of the land in alternative use.

An attempt to estimate the opportunity cost of highway land is described in Annex 1 to these Notes. Using simple assumptions, it is estimated that the 137,236 route-kilometres of provincial highways in Canada in 1990 used some 475,000 hectares of land (or 1.17 million acres, about 1,800 square miles). If valued entirely as farmland, this had a value of some $580 million. If the alternative use included residential development of about 1% of the land, at an average value of $370,000 per hectare, the cost amounted in 1990 to $2.4 billion.

Converting this latter amount to an annual rate, using 10% per year as the opportunity-cost rate for capital assets, as indicated earlier, then allocating land cost among vehicle types according to PCE-km, and finally averaging the car cost over 210 billion passenger-kilometres, the resulting estimate is 0.08¢/pass-km. Given the uncertainty in this estimate, particularly in forecasting alternative use of the land, it is incorporated in the highway infrastructure costs as a rounded 0.1¢/pass-km.

### 5.1.4 Costs of "Control"

In addition, an amount is added for the "control" costs of infrastructure, consisting of the police enforcement costs and driver/vehicle enforcement and control programs for cars, analogous to the air traffic control and navigation systems in other modes. Some sparse evidence suggests police traffic-control costs amounted in 1987 to about $450 million per year.[10] Vehicle and driver registration fees amount to about $64 per vehicle per year,[11] or about $850 million per year. It is guessed for illustrative purposes that these fees just balance the provincial expenses on police traffic services and the other relevant program costs — that is, that the control component of infrastructure costs amounts to about $64 per year in 1990 prices, or 0.36 cents per vehicle-kilometre (¢/veh-km) over an average 17,600 kilometres per vehicle per year. Converted to 1991 prices, and averaged over 1.76 passengers per vehicle, this amounts to 0.22¢/pass-km.

Total infrastructure costs for cars, including construction and maintenance, land and control are finally estimated as 1.82 + 0.1 + 0.22 = 2.14¢/pass-km.

### 5.1.5 Car "User-Borne" Infrastructure Costs, from Road Tolls

The only significant road tolls in Canada are those for the Coquihalla Highway in British Columbia.[12] Revenues were $18.4 million in fiscal year 1988–89, $21.2 million in 1989–90,[13] and $32.9 million in 1990–91.[14]

Separate estimates of revenues from passenger cars and trucks are not available, but a rough guess is sufficient for present purposes. It can be guessed that the total from cars and privately used light trucks would have been about $20 million in 1991.

Because national highway traffic in 1991 is estimated at 210 billion passenger-kilometres, these Coquihalla tolls would have amounted to about 0.01¢/pass-km, clearly not sufficiently large to appear in the system-average car infrastructure costs per passenger-kilometre of Table 3(2)-1.

## 5.2 BUS

### 5.2.1 Highway Construction and Maintenance Costs

The highway infrastructure costs for buses are shown in Table 3(2)-3. They were obtained from the estimates of Nix et al. and modified to allocate all common components by PCE-km with an intercity bus comprising two PCEs. The traffic estimates for bus by type of highway are even more approximate than those for cars and heavy trucks.

The costs per vehicle-kilometre in Table 3(2)-3 are divided by an average occupancy of intercity buses of about 21 passengers, obtained from an average load factor of 45% for an average 47-seat bus, from the investigation of bus carrier costs by Royal Commission staff and consultants.

The weighted average cost for all road types amounts to 0.146¢/pass-km in 1991 prices (rounded in Table 3(2)-3 to 0.15¢/pass-km).

Capital charges are added to this cost following the same reasoning as for car infrastructure costs: that it seems legitimate as a first approximation to **double** the estimated road deterioration costs to allow for charges on the remaining capital value of the road structures. The total costs therefore become 0.146 × 2 = 0.292¢/pass-km.

### 5.2.2 Land Costs

Opportunity costs of highway land attributable to buses can be estimated as for cars, allocating the total opportunity costs, estimated at $240 million per year, according to PCE-km. Intercity buses contribute only some 0.2% of total PCE-km. Their share of land costs would then be about $0.5 million per year. Averaged over total bus travel of 3.3 billion passenger-kilometres, this would amount to 0.02¢/pass-km.

Total bus infrastructure "way" costs, including land, are thus rounded to 0.3¢/pass-km. Costs of traffic control for buses are assumed to be too unimportant to change this rounded total.

## 5.3 COMPARISON OF COSTS AND REVENUES FOR HEAVY TRUCKS

The procedures to identify highway infrastructure costs for cars/light trucks and buses also produce estimates for "heavy trucks" (the class heavy truck refers to any truck with a gross vehicle weight rating over 4.5 tonnes, though the maximum permitted nationally is 62.5 tonnes).[15] The report for the Royal Commission on road construction and maintenance costs provided its interpretations of the relationships between costs and truck axle configurations, axle weights and gross vehicle weights.[16] It allocated common components of costs arising from deterioration due to climate together with central costs of administration on the basis of vehicle-kilometres driven. Its methods provide an estimate of 1989 costs for the provincial highway systems for an average heavy truck of 3.82¢/veh-km, or about 4.17¢/veh-km in 1991 prices.[17]

The Royal Commission staff modifications to those estimates included allocating all common components of costs by PCE-kilometres, with an average heavy truck being 2.5 PCEs. The allocation procedure can then be reduced to the following formula, based on gross vehicle weight (GVW) and equivalent-standard-axle loads (ESALs)[18] as well as PCEs:

**Cost per vehicle-kilometre in 1989 ¢**
**= 0.0235(GVW) + 1.5602(ESALs) + 1.037(PCEs)**

The average heavy truck above consists of 23.3 tonnes GVW, with 1.5 ESALs, and 2.5 PCEs. Its costs then become 5.48¢/veh-km, or approximately 6¢/veh-km in 1991 prices. To allocate fully all highway costs, as was done earlier for passenger cars/light trucks, a cost of the invested capital should also be included. A preliminary approximation, in the absence of a confident estimate of the stock of highway capital, suggests this would be of a broadly similar order to the construction and maintenance cost, about 4¢ to 6¢/veh-km in 1991 prices.[19] The total cost for the average truck then becomes 10¢ to 12¢/veh-km.

Average truck revenues have been estimated using schedules of registration fees for trucks obtained from the provincial governments of Nova Scotia, New Brunswick, Ontario and Saskatchewan, together with a function relating truck fuel consumption to gross weight obtained from a study of road user costs and revenues for Transport Canada.[20] The fuel tax rate is the Canadian average estimated for diesel fuel in 1991 of 13.1¢ (net of normal sales taxes).

For the average heavy truck, the registration fee is approximately $1,000 per year and the fuel tax rate approximately 6¢/veh-km. The revenue from such a truck would be less than the fully-allocated costs of 10¢ to 12¢/veh-km for a truck travelling more than about 20,000 kilometres per year; and for such a truck travelling 100,000 kilometres per year, the excess of cost over revenue would be $3,000 to $5,000.

Similar computations can be made for some typical truck configurations suggested in the report to the Royal Commission by Nix et al., as follows:

| Configuration | Gross weight (tonnes) | Average cost (¢/veh-km) | Registration fee per year ($) | Average fuel tax (¢/veh-km) |
|---|---|---|---|---|
| Straight truck (T3) | 25 | 11–14 | 1,000 | 6.1 |
| Tractor-semitrailer (3-S2) | 39 | 15–19 | 1,700 | 7.1 |
| B-double (3-S3-S2) | 62 | 20–26 | 3,000 | 9.6 |

Revenues would be substantially outweighed by costs for each of these types of trucks if they are used for more than about 20,000 kilometres per year. Using the upper bounds of the cost estimates, the cost for the 25-tonne straight truck used for 50,000 kilometres per year would outweigh revenues by about $3,200; while if the tractor-trailer and tractor-double-trailer trucks were used for 100,000 kilometres per year their costs would outweigh revenues by approximately $10,000 and $13,000 respectively.[21]

Marginal costs would, of course, be lower than the above fully allocated average costs. The research report to the Royal Commission included an initial exploration of the manner in which costs of pavement construction, reconstruction and resurfacing vary with use, which suggests that marginal costs of heavy truck use would be very much lower.[22] Once the common cost elements allocated by PCEs — such as the climate-induced deterioration and administration costs — were ignored, marginal costs would also be more than proportionally less for trucks with lower axle weights (for example, for the double-trailer truck than for the straight truck in the these examples). Similarly, once those common elements are ignored, marginal costs would be less on high-volume roads. A pricing regime designed both to be efficient and to recover the fully allocated costs would need a thorough investigation of the relationships between average and marginal costs.

## 5.4 AIR

Unit costs for airport and air navigation services (ANS) were developed by Sypher : Mueller International Inc.[23] from financial data for expenditures associated with airport and aviation infrastructure. Transport Canada expenditures are shown in Table 3(2)-4; related revenues (excluding the Air Transportation Tax) are also included. Some of the costs for, and revenues from, airport property are not attributable to the provision of airport services, and were excluded from the present cost analysis. Costs, as calculated here, are more comprehensive, particularly in including the economic cost of invested capital.

Airport output statistics and cost and revenue data were provided by Transport Canada on a site-by-site basis. The ANS costs were assembled at the national level and were treated as a network, while airport costs were developed on a site-by-site basis. Enroute ANS services provided for the benefit of international flights that do not land in Canada are budgeted separately by Transport Canada, and are almost exactly recovered from specific fees.

*Table 3(2)-4*
*TRANSPORT CANADA AIR PROGRAM EXPENDITURES AND REVENUES, 1989–90*
*($ MILLIONS)*

| **Expenditures** | **Aviation** | **Airports** | **Total** |
|---|---|---|---|
| Operating | 559 | 363 | 922 |
| Capital | 230 | 209 | 439 |
| **Total** | **789** | **572** | **1,361** |

| **Revenues** | **Aviation** | **Airports** | **Total** |
|---|---|---|---|
| Enroute/Other ANS | 30 | — | 30 |
| Landing fees | — | 128 | 128 |
| General terminal | — | 89 | 89 |
| Airline space rental | — | 50 | 50 |
| Other airline revenues | — | 18 | 18 |
| Commercial/Industrial | — | 186 | 186 |
| **Total** | **30** | **471** | **501** |

**Source: Data from Transport Canada, *1989–90 Estimates: Part III, Expenditure Plan* (Ottawa: Supply and Services Canada, 1989).**

### 5.4.1 Airport Cost Allocation

The Royal Commission developed the infrastructure cost attributable to commercial aviation at each of the 98 airport facilities in which Transport Canada has a significant interest. The 98 airports were divided into four groups for which data with varying degrees of cost detail were available.[24]

*Group I — Lester B. Pearson International Airport (Toronto) and Vancouver Airport:* These are the two largest airports in Canada, both in terms of facilities and operations, and are the only sites in Canada that are currently operating at, or near, capacity. As such they have certain distinct asset utilization characteristics and hence cost functions.

*Group II — Remaining major federal airports (MFAs):* The other six MFA sites (Calgary, Edmonton, Winnipeg, Ottawa, Montreal and Halifax) have facilities roughly the same size and all play a similar role in the national transportation system.

*Group III — Sites processing or capable of annually handling 200,000 enplaned/ deplaned (E/D) passengers:* These sites have a minimum level of airfield and terminal facilities that in most cases is adequate to handle volumes of up to a million passengers. The facilities and operations of airports in this group, and their cost behaviour, are generally similar.

*Group IV — Remaining Transport Canada airports:* These facilities are generally small and provide limited services. They have been further subdivided to segregate, in Group IVb, those airports that might be considered "outliers" because of remoteness and/or because the primary orientation may not be toward serving scheduled commercial carriers.

Groups III and IV are referred to as Federally Dependent Airports (FDAs). Fourteen of the airports in Group III used to be accounted for as MFAs; therefore, more detailed data are available for these ex-MFAs. Excluded from these airport groupings were the hundreds of community airports located across Canada. Because these airports are small, do not provide scheduled services, and only limited financial data is available for them, these sites were not included in this study. These airports, however, are an essential link to many small communities.

Direct operating costs, excluding depreciation, were gathered for each site. The cost allocation methodology and data sources and detail varied by airport group. For MFAs, total direct operating costs and operating costs by profit centre were available; this allowed easy removal of costs that were not to be attributed to users. Costs associated with state and military aircraft, as estimated by Transport Canada, were removed from site operating expenses. Also, emergency response service (ERS) costs were attributed strictly to the commercial passenger services and not to other users, such as the Department of National Defence and general aviation.

Costs associated with concession/groundside facilities and industrial areas were available from detailed costing studies that were performed in 1988–89, which allocated a portion of site costs to each of these profit centres. For the 14 ex-MFAs, total direct operating costs and costs associated with concession/groundside facilities and industrial areas were available for 1987–88 from Transport Canada's Financial Projection System, which also allocated a portion of site costs to each of these areas or profit centres.

The direct total operating costs and industrial costs for the remaining FDAs were extracted from Transport Canada's Statement of Revenue and Expenses. Because the financial data recorded for the FDA sites were minimal, a proxy of 10% was used to remove costs associated with concession/groundside facilities. It was further assumed that the industrial profit centre was operated on a break-even basis, and as such, expenses should equal revenue generated. Data were available on industrial rentals, which then served as a proxy for the costs associated with this area.

The Transport Canada allocation of corporate overhead to operating sites was not adopted. No overhead costs were allocated to the eight MFA sites, as they may be considered self-sufficient. These sites have a full complement of management and administrative functions and do not rely on headquarters for support. Therefore, all departmental overhead costs were allocated among the directly managed sites on the basis of direct airfield and terminal operating and maintenance costs.

Airfield costs have been allocated to commercial aviation traffic and to general aviation traffic[25] (other than for-hire transportation) at each airport on the basis of aircraft weight. At congested sites such as the Toronto (Pearson) and Vancouver airports, a movement-based allocation might be argued to be superior, because each movement imposes approximately the same time demands on the facilities and services capacity. A movement-based allocation, however, would be difficult to defend for uncongested airports, since this method assumes that each movement causes the same amount of "wear and tear" on airport assets, regardless of size. A weight base also may be argued to be related to willingness to pay (and to "Ramsey" pricing[26]) and is a more widely accepted and defensible practice for fee setting.

Terminal costs have been measured in relation to the number of passengers enplaned and deplaned. Terminal costs were allocated solely to commercial aviation with the assumption that general aviation makes only minimal use of the terminal building.

Capital infrastructure was included in the cost base on a current replacement value basis (escalated historical cost).[27] As a cross check, the replacement cost based on facility size, for terminal and runway assets, and current construction costs were calculated for a number of sites.

The replacement value was then divided by the 30-year average life of assets on an airport site to determine the annual allocation of past capital investment (depreciation). For ANS assets a 20-year life was used. The opportunity cost of capital component was calculated by multiplying capital replacement value by 50% to get average depreciated value, and then by a real interest rate of 10%.

For the airport system, four basic cost groups were used:

1. Total Commercial Airfield Costs = Commercial Airfield Operations and Maintenance (O&M) Costs + Commercial Airfield Overhead Costs + Commercial Airfield Capital Costs;
2. Total Commercial Terminal Costs = Commercial Terminal O&M Costs + Commercial Terminal Overhead Costs + Commercial Terminal Capital Costs;
3. Total General Aviation (ga) Instrument Flight Rules (IFR) Costs = ga IFR Airfield O&M Costs + ga IFR Airfield Overhead Costs + ga IFR Airfield Capital Costs; and
4. Total ga visual flight rules (VFR) Costs = ga VFR Airfield O&M Costs + ga VFR Airfield Overhead Costs + ga VFR Airfield Capital Costs.

Terminal costs were allocated to the commercial users on the basis of enplaned passengers, and airfield costs at each airport were allocated to commercial users, ga IFR users, and ga VFR users on the basis of their respective weight landed.

A summary of the cost allocation procedure is shown in Table 3(2)-5. Included here are all operations expenses and revenues, net of expenses and revenues attributable to activities that take place on the airport property but do not directly relate to the services Transport Canada provides to the airline and other aviation users of the facilities. Exclusions include industrial developments on the airport property, parking, and retail and refreshment concessions.

### 5.4.2 Air Navigation Services Cost Allocation

Air navigation costs include the cost of air traffic control, flight service stations, and the provision of radio navigation aids. The cost of ANS was divided between local ANS costs and enroute ANS costs. Local ANS costs are the costs of services provided at each airport (for a 50 km radius) while enroute costs are the costs of services provided while an aircraft is between airports.

Operating costs for both local and enroute facilities were derived from data provided by Transport Canada. The data were available in a form that separated local from enroute services and isolated domestic and international enroute services. The international services (polar and oceanic) are near full cost recovery. Thus, both revenues and expenses were excluded from the calculations, leaving a reasonably accurate picture of the costs and revenues of domestic enroute services. These data were also available from Part III of the 1989–90 Estimates,[28] although the detail required to allocate costs to international enroute services for area control centres and flight service stations was not available. As with the airport costing exercise, these accounts represent only direct operating costs and exclude depreciation.

Overhead costs were extracted from Transport Canada's *Proposed New Cost Recovery Policy: Phase II Discussion Paper* (TP 10041). For ease of allocation, overhead comprised ANS regulation costs, ANS safety costs, ANS branch overhead, and an allocated share of Transport Canada's corporate overhead.

*Table 3(2)-5*

COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS

(THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Operator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I. | | | | | | | | | | | | |
| TC | Toronto | Ont. | 20,269,180 | 53,833 | 45,310 | 32,917 | 40,231 | 118,412 | 87,192 | 6 | 2 | 89 |
| TC | Vancouver | B.C. | 8,840,180 | 20,845 | 15,802 | 13,413 | 20,120 | 49,275 | 38,065 | 6 | 1 | 109 |
| | Subtotal | | 29,109,360 | 74,678 | 61,112 | 46,330 | 60,351 | 167,687 | 125,257 | 6 | 1 | 198 |
| II. | | | | | | | | | | | | |
| TC | Montreal | Que. | 8,761,049 | 49,990 | 36,915 | 44,536 | 50,222 | 131,480 | 55,641 | 15 | 9 | 286 |
| TC | Calgary | Alta. | 4,549,797 | 13,983 | 10,301 | 8,015 | 20,610 | 38,838 | 24,732 | 9 | 3 | 147 |
| TC | Winnipeg | Man. | 2,459,932 | 10,883 | 6,347 | 5,505 | 5,964 | 17,737 | 11,498 | 7 | 3 | 93 |
| TC | Edmonton Int. | Alta. | 2,072,354 | 10,608 | 8,594 | 4,286 | 5,455 | 18,303 | 10,922 | 9 | 4 | 77 |
| TC | Halifax | N.S. | 2,338,372 | 10,101 | 8,264 | 4,351 | 3,024 | 15,613 | 8,531 | 7 | 3 | 83 |
| TC | Ottawa | Ont. | 2,711,415 | 9,495 | 2,763 | 3,573 | 9,660 | 15,931 | 12,667 | 6 | 1 | 66 |
| | Subtotal | | 22,892,919 | 105,060 | 73,185 | 70,267 | 94,935 | 237,901 | 123,991 | 10 | 5 | 751 |

*Table 3(2)-5 (cont'd)*

COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS

(THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Oper-ator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./ overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| III. | | | | | | | | | | | | |
| TC | Victoria | B.C. | 759,878 | 1,843 | 2,259 | 0 | 2,230 | 4,501 | 1,831 | 6 | 4 | 124 |
| TC | Quebec | Que. | 733,774 | 3,542 | 4,487 | 1,822 | 1,916 | 8,155 | 2,882 | 11 | 7 | 204 |
| TC | St. John's | Nfld. | 702,264 | 4,306 | 6,423 | 1,611 | 1,480 | 9,467 | 2,445 | 13 | 10 | 193 |
| TC | Regina | Sask. | 654,249 | 3,284 | 5,069 | 3,161 | 2,153 | 10,239 | 2,859 | 16 | 11 | 317 |
| TC | Saskatoon | Sask. | 642,765 | 2,898 | 4,229 | 1,241 | 897 | 6,293 | 2,794 | 10 | 5 | 276 |
| TC | Thunder Bay | Ont. | 591,975 | 2,764 | 4,202 | 1,068 | 1,030 | 6,202 | 2,111 | 10 | 7 | 374 |
| N | Kelowna | B.C. | 395,436 | 1,544 | 2,529 | 16 | 1,395 | 3,945 | 1,042 | 10 | 7 | 53 |
| TC | Moncton | N.B. | 293,483 | 2,712 | 3,692 | 724 | 710 | 5,062 | 992 | 17 | 14 | 296 |
| TC | Windsor | Ont. | 283,108 | 1,747 | 2,403 | 804 | 1,471 | 4,571 | 1,277 | 16 | 12 | 302 |
| TC | Prince George | B.C. | 275,340 | 2,132 | 3,259 | 1,537 | 1,877 | 6,578 | 710 | 24 | 21 | 247 |
| TC | London | Ont. | 255,643 | 2,463 | 3,119 | 1,137 | 1,039 | 5,116 | 941 | 20 | 16 | 540 |
| TC | Saint John | N.B. | 245,801 | 2,486 | 3,872 | 1,130 | 544 | 5,516 | 1,292 | 22 | 17 | 130 |
| TC | Sault Ste. Marie | Ont. | 245,400 | 1,854 | 2,816 | 17 | 3,308 | 6,147 | 600 | 25 | 23 | 135 |
| N | Sudbury | Ont. | 236,508 | 1,442 | 2,036 | 1,407 | 411 | 3,677 | 377 | 16 | 14 | 444 |
| TC | Fredericton | N.B. | 207,475 | 2,116 | 2,820 | 354 | 636 | 3,802 | 760 | 18 | 15 | 90 |
| TC | Charlottetown | P.E.I. | 205,610 | 2,415 | 3,526 | 693 | 2,573 | 6,768 | 654 | 33 | 30 | 115 |
| TC | Yellowknife | N.W.T. | 192,044 | 2,389 | 3,641 | 841 | 2,465 | 6,916 | 376 | 36 | 34 | 133 |

*Table 3(2)-5 (cont'd)*

### COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS

(THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Operator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TC | Timmins | Ont. | 191,673 | 1,481 | 2,267 | 154 | 2,288 | 4,709 | 463 | 25 | 22 | 57 |
| TC | Sydney | N.S. | 182,456 | 2,382 | 3,889 | 669 | 889 | 5,441 | 588 | 30 | 27 | 62 |
| TC | Whitehorse | Y.T. | 123,659 | 1,928 | 2,644 | 2,891 | 2,295 | 7,300 | 247 | 59 | 57 | 907 |
| | Subtotal | | 7,418,541 | 47,728 | 69,180 | 21,279 | 31,606 | 120,404 | 25,242 | 16 | 13 | 4,997 |
| **IVa.** | | | | | | | | | | | | |
| TC | Deer Lake | Nfld. | 165,292 | 1,453 | 2,418 | 0 | 1,194 | 3,618 | 402 | 22 | 19 | 24 |
| TC | Kamloops | B.C. | 138,478 | 1,294 | 1,950 | 0 | 3,383 | 5,342 | 496 | 39 | 35 | 64 |
| TC | Prince Rupert | B.C. | 131,357 | 1,049 | 1,663 | 1,364 | 3,739 | 6,750 | 179 | 51 | 50 | 34 |
| N | Rouyn/Noranda | Que. | 117,036 | 982 | 1,531 | 1,216 | 462 | 3,169 | 233 | 27 | 25 | 90 |
| TC | Val d'Or | Que. | 114,128 | 2,262 | 3,461 | 23 | 2,339 | 5,836 | 430 | 51 | 47 | 45 |
| TC | Lethbridge | Alta. | 110,717 | 1,269 | 1,809 | 194 | 2,247 | 4,220 | 196 | 38 | 36 | 190 |
| N | Bagotville | Que. | 107,245 | 186 | 68 | 421 | 237 | 305 | 10 | 3 | 3 | 667 |
| TC | North Bay | Ont. | 104,411 | 1,596 | 1,754 | 1,563 | 2,008 | 5,081 | 364 | 49 | 45 | 446 |
| TC | Grand Prairie | Alta. | 103,214 | 1,296 | 1,941 | 1,260 | 3,518 | 6,583 | 340 | 64 | 60 | 260 |
| N | Hamilton | Ont. | 96,909 | 1,038 | 1,085 | 592 | 537 | 1,985 | 203 | 20 | 18 | 606 |
| N | Castlegar | B.C. | 95,926 | 607 | 956 | 809 | 595 | 2,267 | 0 | 24 | 24 | 184 |
| N | Campbell River | B.C. | 93,352 | 546 | 695 | 25 | 762 | 1,484 | 170 | 16 | 14 | 40 |
| N | Cranbrook | B.C. | 90,452 | 916 | 1,528 | 0 | 2,526 | 4,061 | 276 | 45 | 42 | 37 |
| TC | Fort McMurray | Alta. | 90,094 | 1,109 | 1,557 | 614 | 6,305 | 8,398 | 261 | 93 | 90 | 184 |

Table 3(2)-5 *(cont'd)*

### COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS
(THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Operator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./ overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TC | Terrace | B.C. | 89,699 | 1,070 | 1,747 | 1,040 | 2,336 | 5,102 | 177 | 57 | 55 | 54 |
| TC | Penticton | B.C. | 84,612 | 1,073 | 1,657 | 0 | 1.025 | 2,691 | 408 | 32 | 27 | 97 |
| TC | Mont Joli | Que. | 79,586 | 1,499 | 2,452 | 1,522 | 2,788 | 6,748 | 301 | 85 | 81 | 38 |
| TC | Stephenville | Nfld. | 65,602 | 1,833 | 2,959 | 209 | 4,008 | 7,182 | 284 | 109 | 105 | 17 |
| TC | Baie Comeau | Que. | 58,725 | 946 | 1,321 | 643 | 802 | 2,702 | 165 | 46 | 43 | 163 |
| N | Sarnia | Ont. | 49,500 | 751 | 1,194 | 532 | 1,059 | 2,729 | 117 | 55 | 53 | 130 |
| TC | Smithers | B.C. | 47,800 | 587 | 882 | 1,310 | 1,601 | 3,667 | 195 | 77 | 73 | 190 |
| TC | Williams Lake | B.C. | 36,400 | 551 | 831 | 819 | 1,221 | 2,796 | 114 | 77 | 74 | 124 |
| TC | Yarmouth | N.S. | 34,900 | 1,234 | 1,832 | 582 | 1,171 | 3,548 | 131 | 102 | 98 | 117 |
| TC | Quesnel | B.C. | 30,300 | 498 | 764 | 387 | 537 | 1,640 | 89 | 54 | 51 | 110 |
| N | Kenora | Ont. | 26,200 | 444 | 706 | 358 | 158 | 1,198 | 82 | 46 | 43 | 66 |
| N | Charlo | N.B. | 24,276 | 1,025 | 1,602 | 608 | 189 | 2,380 | 197 | 98 | 90 | 71 |
|  | Subtotal |  | 2,186,211 | 27,114 | 40,365 | 16,092 | 46,747 | 101,482 | 5,820 | 46 | 44 | 4,047 |
| **IVb.** |  |  |  |  |  |  |  |  |  |  |  |  |
| TC | Sept Iles | Que. | 151,255 | 2,478 | 3,756 | 1,403 | 2,980 | 8,098 | 536 | 54 | 50 | 123 |
| TC | Fort St. John | B.C. | 137,004 | 1,737 | 2,828 | 0 | 2,992 | 5,828 | 432 | 43 | 39 | 49 |
| TC | Gander | Nfld. | 124,728 | 7,842 | 12,482 | 2,634 | 2,524 | 17,628 | 2,267 | 141 | 123 | 117 |
| N | Thompson | Man. | 109,705 | 706 | 977 | 1,284 | 637 | 2,832 | 300 | 26 | 23 | 112 |
| N | Goose Bay | Nfld. | 80,151 | 6,742 | 5,803 | 5,977 | 20,552 | 32,175 | 609 | 401 | 394 | 251 |
| TC | Inuvik | N.W.T. | 76,305 | 1,365 | 2,025 | 2,729 | 2,950 | 7,642 | 182 | 100 | 98 | 105 |
| TC | Wabush | Nfld. | 74,248 | 1,655 | 2,630 | 1,037 | 1,437 | 5,086 | 282 | 69 | 65 | 68 |

*Table 3(2)-5 (cont'd)*

### COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS
### (THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Operator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./ overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TC | Iqaluit | N.W.T. | 64,852 | 1,564 | 1,377 | 4,410 | 1,182 | 6,932 | 334 | 107 | 102 | 46 |
| TC | Sandspit | B.C. | 40,347 | 853 | 1,205 | 1,029 | 815 | 3,036 | 189 | 75 | 71 | 26 |
| TC | Iles de la Madeleine | Que. | 39,959 | 487 | 810 | 614 | 218 | 1,640 | 119 | 41 | 38 | 8 |
| TC | Port Hardy | B.C. | 39,782 | 714 | 1,051 | 1,710 | 3,187 | 5,830 | 172 | 147 | 142 | 165 |
| TC | Churchill | Man. | 34,692 | 2,656 | 4,234 | 3,951 | 1,368 | 9,524 | 239 | 275 | 268 | 65 |
| TC | Kuujjuaq | Que. | 30,200 | 1,621 | 2,522 | 1,691 | 768 | 4,950 | 165 | 164 | 158 | 84 |
| N | Red Lake | Ont. | 29,800 | 187 | 107 | 523 | 708 | 818 | 111 | 27 | 24 | 697 |
| TC | Norman Wells | N.W.T. | 27,402 | 927 | 1,453 | 856 | 1,261 | 3,528 | 122 | 129 | 124 | 105 |
| TC | Hay River | N.W.T. | 26,070 | 806 | 1,274 | 1,696 | 1,276 | 4,216 | 93 | 162 | 158 | 51 |
| TC | The Pas | Man. | 21,863 | 1,029 | 1,567 | 511 | 411 | 2,464 | 80 | 113 | 109 | 87 |
| TC | Fort Smith | N.W.T. | 19,650 | 525 | 836 | 1,218 | 1,336 | 3,361 | 59 | 171 | 168 | 48 |
| TC | Kapuskasing | Ont. | 18,300 | 312 | 477 | 2,256 | 1,125 | 3,681 | 100 | 201 | 196 | 210 |
| TC | Fort Nelson | B.C. | 14,200 | 863 | 1,265 | 2,605 | 1,781 | 5,329 | 112 | 375 | 367 | 451 |
| TC | St. Anthony | Nfld. | 13,500 | 517 | 827 | 1,217 | 407 | 2,370 | 41 | 176 | 173 | 132 |
| N | Schefferville | Que. | 9,800 | 185 | 261 | 369 | 247 | 846 | 32 | 86 | 83 | 51 |
| N | Wemindji | Que. | 6,200 | 178 | 302 | 803 | 468 | 1,572 | 39 | 254 | 247 | 1 |
| TC | Earlton | Ont. | 4,500 | 213 | 287 | 165 | 142 | 564 | 24 | 125 | 120 | 74 |
| N | Eastmain | Que. | 4,300 | 188 | 302 | 470 | 272 | 1,040 | 17 | 242 | 238 | 6 |
| TC | Abbotsford | B.C. | 4,100 | 856 | 565 | 1,486 | 2,810 | 4,177 | 132 | 1,019 | 986 | 887 |
| TC | Gore Bay | Ont. | 500 | 137 | 145 | 326 | 274 | 582 | 8 | 1,163 | 1,147 | 245 |
| TC | Muskoka | Ont. | 500 | 167 | 160 | 107 | 76 | 287 | 23 | 573 | 528 | 159 |

*Table 3(2)-5* (cont'd)

COST ALLOCATION FOR AIRPORTS, RANKED BY ENPLANED/DEPLANED PASSENGERS
(THOUSANDS OF 1991 DOLLARS UNLESS OTHERWISE STATED)

| Operator | Site | Prov. | 1988 E/D passengers | 1988–89 total operating expenses excluding deprec. | Approx. aviation oper./ overhead costs (1991) | Attrib. airfield capital cost (1991) | Attrib. terminal capital cost (1991) | Attrib. comm. aviation (airlines) cost (1991) | Revenue from comm. aviation (airlines) (1991) | Full cost per E/D pass. ($) | Deficit per E/D pass. ($) | Cost attrib. to general aviation (1991) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | North Battleford | Sask. | 500 | 108 | 114 | 518 | 715 | 1,119 | 5 | 2,238 | 2,229 | 274 |
| N | St. Leonard | N.B. | 500 | 350 | 496 | 505 | 186 | 1,087 | 7 | 2,174 | 2,160 | 200 |
| N | Swift Current | Sask. | 500 | 70 | 76 | 332 | 685 | 889 | 7 | 1,778 | 1,764 | 247 |
| TC | Wiarton | Ont. | 500 | 186 | 179 | 421 | 237 | 608 | 10 | 1,216 | 1,195 | 364 |
| N | Yorkton | Sask. | 500 | 125 | 104 | 378 | 489 | 755 | 8 | 1,510 | 1,494 | 278 |
| TC | Baker Lake | N.W.T. | 0 | 895 | 1,488 | 1,161 | 305 | 2,947 | 10 | # | # | 16 |
| TC | Cambridge Bay | N.W.T. | 0 | 880 | 1,454 | 1,038 | 375 | 2,868 | 49 | # | # | 4 |
| TC | Coral Harbour | N.W.T. | 0 | 1,007 | 1,685 | 865 | 234 | 2,780 | 0 | # | # | 12 |
| TC | Eureka | N.W.T. | 0 | 22 | 37 | 64 | 15 | 116 | 0 | # | # | 1 |
| N | Fort Resolution | N.W.T. | 0 | 172 | 275 | 115 | 69 | 449 | 0 | # | # | 28 |
| TC | Fort Simpson | N.W.T. | 0 | 503 | 783 | 602 | 194 | 1,543 | 24 | # | # | 80 |
| TC | Nanisivik | N.W.T. | 0 | 509 | 857 | 1,063 | 369 | 2,288 | 8 | # | # | 3 |
| N | Resolute Bay | N.W.T. | 0 | 3,554 | 4,842 | 1,572 | 465 | 6,857 | 95 | # | # | 95 |
| TC | Tofino | B.C. | 0 | 46 | 61 | 2,116 | 559 | 2,523 | 1 | # | # | 219 |
| TC | Tuktoyuktuk | N.W.T. | 0 | 341 | 567 | 200 | 75 | 837 | 1 | # | # | 16 |
| TC | Watson Lake | Y.T. | 0 | 883 | 1,249 | 1,219 | 571 | 2,824 | 43 | # | # | 414 |
|  | Subtotal |  | 1,206,413 | 47,161 | 65,794 | 55,246 | 59,747 | 176,526 | 7,087 | 146 | 140 | 6,673 |
|  | **Total** |  | **62,813,444** | **301,741** | **309,637** | **209,214** | **293,386** | **804,001** | **287,397** | **13** | **8** | **16,666** |

Similar to airport capital assets, the value used in the cost base was replacement cost. The replacement value was determined by reviewing the current asset base and known major capital expenditures (such as the current programs of radar modernization and microwave landing systems), and estimating what it would cost to replace these navigation aids. The replacement cost for local and enroute facilities was divided by a factor of 20, which represents the average number of years in the life of ANS capital assets. A cost of capital component was calculated using an interest rate of 10%.

For ANS, as for airports, four cost groups were used:

1. Total Local Commercial and General Aviation (ga) IFR Costs = Local Commercial and ga IFR O&M + Local Commercial and ga IFR Overhead + Local Commercial and ga IFR Capital Costs;
2. Total Local Flight Service Station (FSS) Costs = Local FSS O&M + Local FSS Overhead + Local FSS Capital Costs;
3. Total Enroute Commercial and ga IFR Costs = Enroute Commercial and ga IFR O&M + Enroute Commercial and ga IFR Overhead + Enroute Commercial and ga IFR Capital Costs; and
4. Total enroute VFR Costs = Enroute VFR O&M + Enroute VFR Overhead + Enroute VFR Capital Costs.

Local air navigation services costs were therefore allocated:

| | $ millions (1991) | |
|---|---|---|
| | Local | Enroute |
| Commercial | 137 | 344 |
| General Aviation IFR | 16 | 15 |
| General Aviation VFR | 118 | 75 |

Local costs were allocated to users based on each user's tower arrivals and FSS arrivals. Enroute costs were allocated to users on the basis of domestic total kilometres flown by each group. The resulting cost functions are:

Commercial = \$42.54/movement + \$0.15/km

ga IFR = \$41.16/movement + \$0.15/km

ga VFR = \$82.69/movement + \$1.01/km

Alternatively, the cost attributed to commercial aviation can be allocated on the basis of passengers and passenger-kilometres. To do this, it was first necessary to divide the total among domestic and international services. Cost attributable to overflights that do not land in Canada has already been excluded. For the balance that takeoff and/or land in Canada, to allocate the attributed \$137 million local air navigation services cost, enplanements plus deplanements are estimated as:

| | | |
|---|---|---|
| Domestic | 24 million × 2 × 1.2 stages ⟶ | 58 million E/D |
| Canadian international carriers | | 13 million E/D |
| Foreign carriers (assume) | | 15 million E/D |
| | | 86 million E/D |

This amounts to \$1.60 per passenger per takeoff or landing (1/2 stage).

Enroute costs attributable to commercial aviation of \$344 million may be allocated on the basis of airplane-kilometres under Canadian enroute control, estimated from data on movements and assumptions as to controlled flight length. Itinerant movements in 1990 (Statistics Canada Catalogue No. 51-206, Table 7.1) for commercial carriers are:

| | Movements | Distance |
|---|---|---|
| Domestic | 3,387,000 | 800 kilometres |
| Trans-border | 256,000 | 300 kilometres under Canadian control |
| Other international | 64,000 | 1 000 kilometres under Canadian control |

With the domestic operation accounting for 2.71 billion of a total of 2.85 billion airplane-kilometres, or a share of 95%, enroute costs attributable to commercial domestic operations are $327 million. Allocating over 25 billion domestic passenger-kilometres gives a unit cost of 1.4¢/pass-km.

### 5.4.3 Air Infrastructure Cost (Excluding Land Occupancy)

The final product was the set of cost functions that estimate the unit costs of airport and aviation infrastructure in Canada. By applying the commercial carrier cost model, it was possible to calculate an average cost per passenger from any origin to any destination in Canada.

To calculate the average infrastructure costs applicable to a typical trip, the airport cost function and the corresponding air navigation cost function are used. As an example, consider a trip to Saskatoon from Halifax of approximately 3 500 km, in a B-727 or A320 aircraft with 136 seats, operating at a (system-average) load factor of 0.675, via one intermediate stop (change of flights) at Toronto. The trip thus has two stages, which means two takeoffs and two landings at three airports.

The attributed commercial airlines' costs at Saskatoon, Toronto and Halifax from Table 3(2)-5 give a per passenger airport cost of:

| | |
|---|---|
| Halifax | $ 7 |
| Toronto (two movements) | $12 |
| Saskatoon | $10 |
| | $29 |

Total navigation costs would be:

$6.40 + 3 500 km at 1.4¢ = $55[29]

Not including cost attributable to investment in land, total costs per passenger of air infrastructure services are estimated at $84. Including $20 for the opportunity cost of land in use at the airports, total infrastructure cost becomes $104 per passenger (use of unrounded intermediate data would yield $105).

### 5.4.4 Cost of Land Used for Airports

One can only speculate about the extent and type of development that would take place if the airports were removed from their current sites. Unique mixes of types of use are likely at each of the sites.

An attempt to estimate the opportunity costs of airport land is described in Annex 2 to these Notes. For the nine major airports, potential values as farmland, or in industrial, commercial or residential development are considered.

The areas of land occupied by these airports are very large, and in a number of cases are in locations that would be advantageous for development if the airports were abandoned (or relocated). The areas concerned, however, are so large that they would add substantially to the land available, and could probably only be sold for development at prices below those currently attained for equivalent land.

Indications of potential values of the land at these airports is provided in Table 3(2)-6, based on the following assumptions (described further in Annex 2):

- The sites at Edmonton, Mirabel and Halifax airports are valued as farmland.
- At Calgary, Winnipeg and Ottawa airports, the sites are valued at 25% of the current price for light industrial land.
- For Vancouver and Dorval airports, the available land is valued at 50% of the current price for light industrial land.
- For Toronto (Pearson) airport, the site area is valued at 50% of the current price for residential land.

*Table 3(2)-6*
*Opportunity Costs of Land at Major Airports, 1991*

| Airport | Estimated land values ($ millions) |
|---|---|
| Vancouver | 500 |
| Calgary | 200 |
| Edmonton | 8 |
| Winnipeg | 130 |
| Toronto (Pearson) | 750 |
| Ottawa | 440 |
| Montreal (Dorval) | 400 |
| Montreal (Mirabel) | 10 |
| Halifax | 1 |
| **Total (rounded)** | **2,500** |

The value of those nine major airports is therefore estimated at about $2.5 billion. For the 20 next most important airports, it is assumed that the average value per hectare is half that of these nine airports, excluding Pearson and Vancouver. Their total value would be about $400 million. For all remaining airports, the value of the land is assumed to be negligible.

The total capital value estimated therefore is about $2.9 billion. At a real rate of return of 10%, the annual cost is $290 million per year. Averaged over a total of about 63 million enplaned/deplaned (E/D) passengers at all airports in 1988, the total land value would then amount to $4.60 per passenger. For the illustrative system-wide costs in 1991, this is rounded up to $5 per E/D passenger, or $10 per stage. Averaged over the representative air trip (1.6 stages) of 1 478 km, it amounts to 1.08¢/pass-km (rounded to 1¢/pass-km for system average).

## 5.5 RAIL

The Royal Commission's intercity railway carrier costing is described in Volume 4 of this report.[30] The cost of infrastructure services is shown but there was no cost analysis beyond acceptance of the price

VIA Rail pays the freight railways for track use. Infrastructure payments, including some station rents and incentive payments, which amount to 2.9¢/pass-km, represent only a relatively small proportion of VIA Rail's costs — about 7%. On the per passenger-kilometre basis, however, they are somewhat higher than the estimate of car infrastructure costs and much higher than the estimate of bus costs. Rail track costs are also discussed in the Notes to Chapter 6 in this volume, but without focus on the costing methodology.

The charges VIA Rail pays for track use are closer to being based on a marginal cost concept than on the fully allocated average cost concept used in costing infrastructure for all the other means of passenger transportation.

Payments by VIA Rail to the freight railway track owners for track use and other related services, such as dispatching, signals and communications, are negotiated among the parties — including the Minister of Transport's representative. Should agreement not be reached, however, the fall-back position is long-term avoidable cost as defined by regulations administered and interpreted by the National Transportation Agency. The relationship between CN and CP charges to VIA Rail, and the additional cost that the passenger operation actually imposes on the freight railways, have formed the topic of review by the Canadian Transport Commission and the National Transportation Agency (most recently, the NTA's 1988 *VIA Rail Costing Review*), and a variety of studies by, and for, interested parties including the provincial governments.

The applicable regulations (essentially, the CTC's Costing Order, R-6313) in effect interpret avoidable cost in this case as being long-run variable cost, with respect to track use, including the variable portions of maintenance expense and of capital-related costs — depreciation and cost of capital. Capital-related costs are based on depreciated original cost, historical asset lives, the cost of capital for CP computed in nominal dollars, and an estimated relationship between track maintenance operating expenditures and gross tonnage. As already noted, this differs from the estimate of allocated total cost, with capital treated on a replacement value basis, that was used for the other modes.

It may be of interest to observe that, for rail freight, infrastructure costs generally and the cost of the capital invested in the track infrastructure are much more important relative to total costs than they are for passenger transportation. The 1989 balance sheets for CN and CP[31] show a combined "ways and structures" property investment of over $10 billion at original cost (over $8 billion of it track and roadway), with accumulated depreciation of approximately $3 billion. At a nominal cost of capital of 15% (10% real plus 5% inflation), $7 billion of invested capital represents an annual cost of invested capital of over $1 billion. This equals 20% of 1989 gross freight revenues.

Allocating a pro rata share of this rough estimate of an infrastructure capital charge using the industry rule of thumb — 1 pass-km = one freight tonne-km — would only suggest an $11 million allocation to passenger costs — the equivalent of 0.4¢/pass-km — in 1989. This may be viewed as an indication of the maximum understatement of passenger rail infrastructure costs relative to costs for other modes, as VIA Rail payments would, in principle, already include a capital charge related to a portion of the capital implicitly allocated to it on this pro rata basis.

## 5.6 FERRY

The infrastructure provided for marine ferries not included in vehicle/carrier cost estimates comprises the navigation services and regulatory activities provided by Transport Canada. The amounts of these services provided for the ferries cannot be distinguished readily, as the services are provided jointly for all shipping. Analyses published as part of the development of Transport Canada's cost-recovery policy do not yet provide an allocation of costs to each type of user, but do distinguish attributable costs in 1990–91 for a number of programs.[32] Programs assumed to be used (or provided) in part for ferries are the following (costs include allowances for depreciation and costs of capital):

| | Total costs, 1990–91<br>$ millions |
|---|---|
| Vessel traffic services | 17.46 |
| Short-range navigation aids | 272.98 |
| Safety and public communication | 14.53 |
| Ship safety | 32.66 |
| Emergencies | 25.05 |
| Total | 362.70 |

It is reasonable for illustrative purposes, and in the absence of information on the use of these services by ferries, to allocate the services among various types of commercial shipping according to ship-kilometres travelled in Canadian waters. Using Transport Canada's estimate that ferries account for 11.84%, the amount of the total cost thus attributable to ferries is $42.94 million.

This amount is then distributed between freight and passenger ferry traffic as are the other ferry cost items, according to automobile-equivalent-unit kilometres. The passenger portion is estimated as $35.4 million.

Averaging this cost over the total (non-commercial) passenger-kilometres in 1990 produces a (rounded) 4.5¢/pass-km. When inflated to 1991 dollars, this amounts to 4.7¢/pass-km, which appears in Table 3.1 of Volume 1.

# 6. ENVIRONMENTAL DAMAGE COSTS

## 6.1 EMISSIONS OF AIR POLLUTANTS AND GREENHOUSE GASES

Derivations of costs of emissions are described in the Notes to Chapter 7 in this volume. System-wide averages estimated there (in Table 7(2)-7) are the following (in 1991 prices):

| Means of Travel | Costs (¢/pass-km) |
|---|---|
| Bus | 0.246 |
| Car | 0.577 |
| Train | 0.642 |
| Airplane | 0.921 |
| Ferry | 1.972 |

## 6.2 NOISE

While noise can be an important component of nuisance from all modes, its effects are localized, and greatest in residential locations exposed to high traffic volumes. Most of the noise from intercity passenger travel by road vehicles, trains and ferries is generated away from areas of dense habitation, but airplane noise is a very substantial nuisance close to major airports.

Derivation of an estimate of the cost of airplane noise is also briefly described in the Notes to Chapter 7 in this volume. Valued at $1.00 per passenger-trip system-wide, this noise cost becomes 0.07¢/pass-km over the representative trip of 1 478 km. This is included in the system-average environmental cost for airplane travel in Table 3-1 of Volume 1 and Table 3(2)-1.

No costs are included for noise in any of the other modes, partly because research has not provided comparable estimates for intercity travel by the other modes, and partly because it is expected that such costs would be very small in relation to the other cost estimates and their ranges of uncertainty.

## 7. ACCIDENT COSTS

The derivation of costs of damage in accidents is described in the Notes to Chapter 8 in this volume. Minimum losses per victim are estimated, from research on road accidents, as $330,000 per fatality and $10,000 per person injured, in 1990 prices. The alternative value of the losses per fatality, adopted recently by Transport Canada after researching individual willingness to pay for risk reductions, amounts to $1.5 million, in 1991 prices. That value has been adopted in the costing by mode that follows, together with $10,000 per person injured, where relevant.[33]

### 7.1 CAR ACCIDENT COSTS

The value for the social losses in all road accidents based on the Transport Canada values per casualty, together with estimates of other property damage losses, is estimated in Chapter 8 at about $14 billion, in 1991 prices.

To be compatible with the estimates of infrastructure costs, an estimate is needed of the amount of these losses that takes place on the paved provincial highway system. National road accident statistics show that some 65% of deaths and 30% of injuries were on roads with speed limits greater than 60 km/h. Those injuries and property damage accidents occurring on highways, however, are likely to be much more severe than the average (occurring at higher average speeds), and therefore to cost substantially more than the average.

The statistics also fail to show what proportion of highway accidents involves passenger vehicles. Strictly, deductions should be made for the losses attributable to non-passenger vehicles. The most important other group of vehicles is heavy trucks, because of their over-involvement in severe casualties. Available statistics show them to be involved in about 3% of all accidents, and about 9% of deaths. But no information is available to determine responsibility for those accidents and casualties.

The simple assumption is made that 55% of the total accident damage cost is on highways and attributable to passenger vehicles, or a total of about $7.7 billion per year. Given its uncertainty, this figure is rounded to $8 billion. Averaged then across 210 billion total passenger kilometres by these vehicles, this would amount to about 3.8¢/pass-km. This figure appears in Table 3-1 of Volume 1 as the "total accident" cost for car travel.

Of this total amount, there is a proportion of health care costs for road accident victims that is not recovered from motor vehicle insurers, but borne instead by others. This is estimated in the Notes to Chapter 8 in this volume as about $300 million in total in 1990. Using the earlier assumption, 55% or $165 million of this would be attributed to highway passenger traffic. Averaging this over 210 billion passenger kilometres and inflating gives 0.082¢/pass-km in 1991 prices, which appears (suitably rounded) in the relevant cell in Table 3-1 of Volume 1.

The remainder of the 3.8¢/pass-km in losses is user borne, or 3.7¢/pass-km in the rounded figures of Table 3-1.

It should be noted that these estimates may conceal a large element of non-monetary cost, which is borne by the victims of accidents without compensation. (Monetary costs include loss of earnings as a result of death or injury.) Of the amounts estimated earlier to be borne by users, the largest part is borne in costs of accident insurance and the deductible amounts of damage claims paid personally by vehicle owners. However, being based on "willingness to pay," the estimates include a large portion that would represent non-monetary damage in accidents — remembering that monetary damage losses sum to only about $9.5 billion in 1991 prices. The other $4.5 billion can be characterized as representing instead the emotional losses. If 55% of these occur in highway accidents, they amount to about $2.5 billion. These losses are probably not compensated fully, if at all, by those responsible for the accidents, or their insurance companies. The amount concerned is unknown, as the extent of compensation from insurance companies or directly from responsible owners/drivers is not recorded.[34]

It should be further noted that some part of those emotional losses are actually borne by non-users of motor vehicles — essentially pedestrians and bicyclists — in highway accidents (it being assumed that their monetary losses are compensated from insurance and health care systems). As these groups constitute about 15% of all road accident fatalities, they might account for 15% of the total emotional losses. The amount might be substantial compared with many of the component costs borne by non-users in Table 3-1. If total emotional losses were as great as $2.5 billion, and if 15% of that was borne by non-users of motor vehicles it would be close to $400 million. The amount is more likely some fraction of this. Any estimate would be entirely conjectural, however, so this cost has not been distinguished in the tables, and remains within the estimate of user-borne accident costs.

## 7.2 BUS ACCIDENT COSTS

The fatality rate in passenger operations is estimated in the Notes to Chapter 8 in this volume, from the (very sparse) information available on intercity bus accidents from Transport Canada, as 2.0 per billion passenger-kilometres. If Transport Canada's guidance of $1.5 million per death avoided is applied to these, a total of $3 million per billion passenger-kilometres, or 0.3¢/pass-km is obtained.

The accident statistics also show that the ratio of injured victims to fatalities was about 38 (265 injured versus 7 killed in the sample of jurisdictions and years considered). Applying Transport Canada's cost of $10,000 per injured victim, the ratio of injury cost to fatality cost would be 0.20. Adding the injury cost to the fatality cost produces a combined cost of 0.36¢/pass-km.

Finally, an approximate allowance for property damage can be made, in the absence of statistics on the incidence of property damage accidents involving intercity buses, from the observation that the total costs estimated for property damage in road accidents amounts to about two thirds of the total costs of injuries. Adding this proportion would bring the system-average bus accident costs up to 0.4¢/pass-km.

Of this cost, some small amount would be borne by non-users, for similar reasons as for car accident costs. The amounts would probably be similar in proportion — about 2% of accident costs, or in this case only 0.008¢/pass-km. The relevant cell in Table 3-1 therefore shows 0.0¢/pass-km.

## 7.3 AIRPLANE ACCIDENT COSTS

For levels 1 and 2 carriers, the average fatality rate over the decade to 1990 is estimated in the Notes to Chapter 8 in this volume as 0.13 deaths per billion passenger-kilometres. At $1.5 million per fatality, that amounts to only 0.0195¢/pass-km.

The uncertainty of the fatality rate is underlined, however, by the fact that if the Nationair crash at Jeddah in 1991 is included the decade's fatality rate would change to 0.60 per billion passenger-kilometres, in which case, the cost would be about 0.09¢/pass-km.

The cost of injuries and property damage should be added to these costs. In air crashes, injuries are not numerous enough compared with fatalities to make much difference to the estimated cost. No estimates of the extent and costs of property damage in passenger aircraft accidents in Canada are available, but the price of passenger-carrying airplanes suggests that it could be significant. On the other hand, the average cost is unlikely to be as much as that estimated for the victims; at Transport Canada's value of $1.5 million per person, even the most expensive modern airplane is worth less than its passengers.

In summary, it is concluded that the true cost of airplane accidents is unlikely to exceed 0.1¢/pass-km, which is the value used in the illustration.

As with bus accident costs, the amount of these air accident costs borne by non-users is expected to be so small that the relevant cell of Table 3-1 appears as 0.0¢/pass-km.

## 7.4 TRAIN ACCIDENT COSTS

The estimates in the Notes to Chapter 8 in this volume show the rate of all fatalities involving passenger trains over the decade to 1990 as 13.8 per billion passenger-kilometres. The great majority of these deaths were to motor vehicle users at grade crossings or people walking on the rail lines (including suicides). The question arises whether their costs should be attributed as a social cost of rail transport. In nearly all such cases, the railway is not legally at fault; though the deaths would clearly not have occurred in the absence of the trains. This issue is not resolved here, but for the illustrative costs, none of the costs of these other victims has been attributed to the train.

Deaths to passengers and rail employees in passenger operations, which are therefore assumed to be attributable to train travel, occurred at a rate of 1.16 per billion passenger-kilometres over the decade. Valued at Transport Canada's average of $1.5 million, the cost of these deaths amounts to 0.17¢/pass-km, in 1991 prices. To this should be added the costs of those passengers and employees injured in these accidents.

In the absence of details of the numbers injured in passenger operations during the decade, some indication of the long-term relationship between numbers killed and injured can be gained from the statistics for all main-line railway accidents, which show a ratio of 27 injured for each death (976 injured compared with 36 killed over the decade). Using Transport Canada's road accident costs of $10,000 per average injured victim, this would add $270,000, or 18%, to each $1.5 million in costs of fatalities. This would raise the estimated system-average accident cost to 0.20¢ per pass-km.

The amount borne by non-users is again not zero, but expected to be so small that the relevant cell of Table 3-1 appears as 0.0¢/pass-km.

### 7.5 FERRY ACCIDENT COSTS

The fatality rate in ferry operations is estimated in the Notes to Chapter 8 in this volume as 0.5 deaths per billion passenger-kilometres. It is assumed that injuries are insignificant compared with deaths, as most deaths are by drowning (and given the differences in the average costs per victim injured and killed).

Valued at Transport Canada's cost of $1.5 million per person killed, the accident costs amount to 0.075¢/pass-km, which is quoted in Table 3-1 as 0.1¢/pass-km. Once again, the non-user portion is not zero, but negligible in Table 3-1.

## 8. VEHICLE/CARRIER COSTS AND SPECIAL TRANSPORTATION TAXES/FEES

### 8.1 CAR

As described in Volume 1 of this report, the term "car" is used as a shorthand reference for all private passenger vehicle use, most of which is in passenger cars, but with a significant proportion being in light trucks (30 billion passenger-kilometres, of a total on the "highway" system of 210 billion, or about 14%). Light trucks are mostly pickup trucks and passenger vans — defined as under 10,000 lb. (4 550 kg) laden weight, but nearly all under 6,000 lb. (2 725 kg) laden. Their cost characteristics are somewhat different from those of passenger cars; therefore, it is necessary to estimate costs for an average vehicle, blending costs for cars and light trucks in proportion to their use.

A report for the Royal Commission provided estimates of the costs of vehicle ownership and operation separately for cars and light trucks. Of these costs, insurance costs are included within user-borne accident costs, and vehicle licence costs and fuel taxes are included as special taxes/fees. Vehicle/carrier costs consist of the remaining costs of vehicle ownership and use. Costs for maintenance, depreciation and cost of capital are shown in Table 3(2)-7.[35] Estimates summarized in this table were provided for 1990 and are inflated to 1991 prices in the final column. The combined average figures weight the use of cars and light trucks by their total passenger-kilometres.

*Table 3(2)-7*
*Average Unit Costs: Cars and Light Trucks*

| | $/veh per year (1990) | ¢/veh-km (1990) | ¢/pass-km (1990) | ¢/pass-km (1991) |
|---|---|---|---|---|
| **Cars** | | | | |
| Maintenance | 409 | 2.3 | 1.3 | 1.4 |
| Depreciation | 1,230 | 7.0 | 3.9 | 4.1 |
| Cost of capital | 1,020 | 5.8 | 3.2 | 3.4 |
| **Light trucks** | | | | |
| Maintenance | 409 | 2.3 | 1.5 | 1.6 |
| Depreciation and cost of capital | 2,030 | 11.3 | 7.5 | 7.9 |
| **Average passenger vehicle** | | | | |
| Maintenance | 409 | 2.3 | 1.3 | 1.4 |
| Depreciation and cost of capital | 2,210 | 12.6 | 7.2 | 7.5 |

The cost of fuel is estimated for mid-1991 from a national average price (weighted by sales) of 55¢/L of gasoline, together with approximate average highway fuel consumption of 9 L/100 km for cars and 12 L/100 km for light trucks, together with average highway car occupancy of 1.8 passengers and light truck occupancy of 1.5 passengers. The cost for cars is 55/(100/9) = 4.95¢/veh-km, and 4.95/1.8 = 2.75¢/pass-km, and for light trucks 55/(100/12) = 6.6¢/veh-km, and 6.6/1.5 = 4.4¢/pass-km. Combined in proportion to passenger-kilometres driven, the blended average "car" fuel cost is 2.95¢/pass-km.

From this cost of fuel, the amount paid as special tax is deducted, and then appears as part of the "special tax/fee" item in the system average cost table instead of as a "vehicle/carrier" cost component. The relevant amount of tax is defined to be the amounts of provincial and federal taxes on gasoline in excess of the normal amounts of sales taxes charged in the jurisdictions concerned. The calculation is documented in Table 3(2)-8.

The federal excise tax of 8.5¢/L is included as part of the special charge for use of transport, but not the federal GST. Quebec's defined provincial excise tax is included without adjustment. In all other provinces, a motive fuel tax is charged instead of the normal provincial sales tax. Subtracting the amount that could have been charged as provincial sales tax leaves the component of the special charge for use of transport. The total of these charges averaged 17.8¢/L in 1991, when weighted by fuel use by province. Using the assumption of 9 L/100 km for cars, this special tax is therefore 1.6¢/veh-km, or 0.89¢/pass-km. For light trucks using 12 L/km it is 2.14¢/veh-km or 1.42¢/pass-km. The blended average for car is 0.95¢/pass-km. When combined with licence fees, which average 0.22¢/pass-km (see subsection 5.1.4), the total special transportation tax/fee for cars is thus rounded to 1.2¢/pass-km.

It is estimated that the net amount of fuel cost to be included in vehicle/carrier cost is, therefore, 2.95–0.95 = 2.0¢/pass-km. Total vehicle/carrier cost is the sum of the amounts estimated earlier for maintenance, depreciation and cost of capital, and fuel, or 1.4+7.5+2.0 = 10.9¢/pass-km (rounded) at 1991 prices.

*Table 3(2)-8*

## FUEL TAX RATES PER LITRE: 1991 AVERAGE

| | British Columbia | Alberta | Saskat-chewan | Manitoba | Ontario | Quebec | New Brunswick | Nova Scotia | Prince Edward Island | New-foundland | Canada Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Federal Excise** | | | | | | | | | | | |
| Gasoline | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | **8.5** |
| Road diesel | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | **4.0** |
| Aviation turbo | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | **4.0** |
| Locomotive | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | **4.0** |
| **Provincial Special Tax — In Excess of the Standard Sales Tax Rate** | | | | | | | | | | | |
| Gasoline | 7.3 | 8.4 | 7.6 | 7.3 | 9.4 | 11.9 | 7.3 | 8.0 | 7.2 | 7.5 | **9.3** |
| Road diesel | 7.8 | 8.5 | 7.3 | 8.1 | 9.0 | 10.5 | 8.3 | 10.5 | 7.6 | 9.0 | **9.1** |
| Aviation turbo | 1.5 | 5.0 | 5.1 | 3.9 | 0.2 | 3.0 | -1.4 | -2.5 | -2.7 | -3.4 | **1.8** |
| Locomotive | 1.5 | 9.0 | 13.1 | 11.7 | 2.0 | 3.0 | 0.9 | -3.1 | 9.0 | -3.7 | **5.5** |
| **Total Special Taxes — Federal plus Provincial** | | | | | | | | | | | |
| Gasoline | 15.8 | 16.9 | 16.1 | 15.8 | 17.0 | 20.4 | 15.8 | 16.5 | 15.7 | 16.0 | **17.8** |
| Road diesel | 11.8 | 12.5 | 11.3 | 12.1 | 13.0 | 14.5 | 12.3 | 14.5 | 11.6 | 13.0 | **13.1** |
| Aviation turbo | 5.5 | 9.0 | 9.1 | 7.9 | 4.2 | 7.0 | 2.6 | 1.5 | 1.3 | 0.6 | **5.8** |
| Locomotive | 5.5 | 13.0 | 17.1 | 15.7 | 6.0 | 7.0 | 4.9 | 0.9 | 13.0 | 0.3 | **9.5** |

## 8.2 INTERCITY BUS

To generate the system-average costs of intercity passenger bus in Table 3-1 and the illustrative route examples of Tables 3-2, 3-3, 3-4 and 3-5, a simple method based on published data[36] was used.

| | ($ millions) |
|---|---|
| For classes 1 and 2: | |
| Taking operating expenses minus | 316.4 |
| bus depreciation expense | – 14.4 |
| equals: | 302.0 |
| Attributing an estimated 75% to intercity | × 75% |
| passenger unit toll services gives: | 227 |
| Adding approximate average replacement-value-based depreciation and cost of capital ($32,000 multiplied by 1,273 buses) | + 41 |
| equals the total for classes 1 and 2 | 268 |
| For total activity: | |
| Prorating for the intercity unit toll services of operators other than classes 1 and 2 (an additional 273 million pass-km or 8.3%) results in: | 290 |
| Allowing for a reduction in the level of activity from 1989 to 1991, in line with the long-term trend (2 years at –2.9%) provides: | 274 |
| Inflating 1989 dollars to 1991 dollars (2 years at 4.5%) gives a final total of: | 299 |

This figure, $299 million, is the total to be found under users in Table 3-1(b). Divided by the estimate of 3.3 billion passenger-kilometres, it implies a system-average users cost of 9¢/pass-km.

The special tax/fee for bus travel consists of fuel tax and vehicle licence fees. Fuel use is estimated by Royal Commission staff to average 0.405 L/bus-km, or 0.019 L/pass-km with average occupancy of 45%. Federal and provincial special taxes on diesel fuel, in excess of normal sales taxes, averaged 13.1¢/L in 1991. The average fuel tax was therefore 0.25¢/pass-km.

Provincial vehicle licence fees for intercity buses average about $500 per year,[37] or less than $0.5 million in total for about 1,000 buses engaged in intercity scheduled services in Canada. Averaged over 160 000 km per bus per year, the fee is less than 0.6¢/veh-km and at 45% occupancy is therefore 0.015¢/pass-km. Adding together fuel tax and licence fees gives a rounded average of 0.3¢/pass-km.

In considering the possible relaxation of economic regulation of the intercity bus industry (discussed in Chapter 13 of Volume 1), it was desirable to assess the importance of cross subsidization across different route types under the current regulatory regime. For this purpose, a much more detailed study of intercity bus carrier costing was undertaken; this study by Lake et al. is included in Volume 4 of this report.[38]

Two cost formulas were developed to reflect the differences between the major, large-scale carriers and the small-scale, often remote carriers. These formulas were based on cost and statistical data made available to Royal Commission staff on a confidential basis by various bus operators. For the study of cross subsidization within the intercity scheduled bus industry, the formulas were applied to a sample of actual routes, and the results examined as reported in Lake et al.

This method introduced output units into the costing, which allowed the cost characteristics of different types of routes to be captured. The usual measure used by the bus industry for cost analysis is the bus-mile.[39] However, for the analysis of cross subsidization, cost categories were attributed according to a notion of the relationship to bus-miles: using bus hours to reflect the different time to distance ratios of some services, and a per-passenger element to reflect costs that are variable with the volume of traffic (number of passengers) but not with distance travelled. For most cost categories, there was insufficient consistency among the accounting definitions used by the various carriers to justify basing an estimate on averages. Rather, cost components from different sources were blended to achieve unit costs that appeared to represent a typical or normal level of cost.

Replacement value based depreciation and cost of capital charges for buses were included in the bus-hour cost:

| | |
|---|---|
| Cost of new bus (1989–1990) | $260,000 |
| Average life | 10 years |
| Cost of 5-year-old bus | $100,000 |
| End of life salvage | $20,000 |
| Depreciation | straight line |
| Real cost of capital | 10% |

This results in an ownership cost per year for a new bus (assumed for the large-scale operations) of $38,000, and for a five-year-old second-hand bus (assumed for the small-scale operations) of $22,000. The unit cost reflecting bus time was calculated per scheduled bus hour. This made calculation of the cost for specific services easier, because the cost includes an idle or utilization factor. Analysis indicated that there are between three and a half and five buses owned for every one actually moving and carrying passengers on scheduled service at an average point in time. Overall, it was estimated that, for every hour that a bus is moving with passengers, it has spent or will spend more than three and a half hours in terminals, in a garage, or available for service. This factor was calculated using bus inventory, bus mileage and an estimate of average schedule speed of 40 or 50 mph (65 to 80 km/h). It only provided a rough approximation, but data required to make more dependable estimates were not available.

The calculated cost per passenger included a cost for terminals that represents terminal charges or rent (based on data from carriers that rent terminals). Some carriers own all of the terminals they use, some do not own any. Most of the large carriers own some terminals and pay charges or rent for the shared or exclusive use of others. The owners of at least one major carrier own a terminal that is treated as a separate profit centre, charging the bus operation for its use.

The data were combined in an effort to present a reasonable approximation of the industry cost structure without disclosing data for any single contributor. It proved impossible to mask fully the costs of one or more of the large carriers; thus, only the qualitative conclusions, and not the specific cost estimates have been included in the study. The estimates could be used without endangering confidentiality, however, to develop differentials by which costs calculated for types of routes — used in the sample route tables of Chapters 3 and 18 of Volume 1 — differed from the system-average costs and fares outlined at the start of this section and presented in Table 3-1 of Volume 1.

## 8.3 AIRPLANE

The unit-cost development was based on an analysis of system data designed to allow some recognition of factors that contribute to differences in costs of different types of flights.

The analysis, however, does not consider network size or configuration, or a number of other reasons why marginal cost, or the cost of domestic services isolated from international operations, might depart markedly from the unit-cost estimates.

The estimates are based on 1989 data and a 1989 industry; in the case of the Level 1 carriers some modifications were made as later data became available. It may be noted that several of the carriers included in the data for independent jet carriers were, as of 1991, no longer operating. Developing an estimate of total air carrier costs for domestic services from the costs for a typical domestic air journey, however, avoids any biases that this might have created.

The air service costing was based on data provided by Statistics Canada, supplemented with information provided by airlines. These were allocated according to operational relationships, making use of a number of earlier studies.[40] This process benefited from the comments of Air Canada, Canadian Airlines International and the Air Transport Association of Canada.

The airlines' cost data do not separate freight from passenger operations. To the extent that passenger seats and (belly) freight capacity are jointly produced, separation for the present analysis was arbitrary. Because the purpose of the exercise was to develop passenger costs, and because freight carried by carriers represented approximately 10% of revenue, costs for Level 1 were reduced by 5%, presuming that one half of the freight was carried in belly space. Freight was not considered for carriers other than Level 1.

Air services available to passengers in Canada vary from single-engine charter float-planes to trans-Atlantic and trans-Pacific direct flights in B-747 aircraft with more than 450 seats. Scheduled carriers, Levels 1 to 3, account for 97% of Canadian carrier costs. The costing was performed separately for the Level 1 carriers (Air Canada and Canadian Airlines International), a sample of independent jet carriers (Nationair, Quebecair, Soundair, Worldways, Canada 3000, Execair, Holidair and Vacationair) and a sample of turboprop connectors or commuter carriers (Air Alliance, City Express, Ontario Express, Air Atlantic and Air Ontario).

Instead of the more conventional, strictly time-based approach, expense data were adjusted to remove aircraft depreciation expense and rentals, supplemented by a replacement value aircraft capital recovery charge at an interest rate of 10%, and attributed to four output units:

- seat-kilometres;
- seat-stages;

- passenger (same airplane) flights; and
- passenger trips.

The cost allocation for the Level 1 carriers for 1991 (1989 data adjusted to 1991 cost levels) is shown in Table 3(2)-9 on the following page. The table is based on costs of all passenger services, international and domestic. Treatment of the other carrier categories is briefer.

Although recent years have seen considerable fluctuation, an average load factor of 67.5% was taken — from Air Canada and Canadian Airlines International (PWA Corporation) annual reports — as representative of sustainable performance in this regard. Revenue passenger-kilometre, seat-kilometre, passenger-flight, revenue-passenger and other intermediate output units such as average stage,[41] flight and trip lengths (as estimated from Statistics Canada data, data provided by the airlines and airlines' annual reports[42]) allowed estimates of the necessary output units.

Unfortunately, the data did not always appear consistent. This imprecision, however, was not greater than that of the overall costing exercise and should not compromise the results. The uncertainty included average flight length and passenger-trip length; Statistics Canada counts flight coupons and hence overestimates trips where there are changes of planes. Estimates of an average 1.15 aircraft stages per flight and 1.16 flights per passenger trip[43] were based on data from Statistics Canada Catalogue No. 51-206, Table 2.3 and airline data; the Statistics Canada's Canadian Travel Survey[44] reported the 23 million passengers handled.

Flight-crew costs are allocated on the basis of flying hours. The literature (cited earlier) included regressions of Canadian airlines' turbojet flight time against distance. The regression selected (Moloney, 1985) was the most comprehensive. Flight-time estimates were calculated as a constant of 0.4006 hours per stage plus 0.0020 hours per mile. It is further noted that crew costs vary with aircraft type; smaller airplanes (that typically operate on shorter stages) generally have higher crew

Table 3(2)-9

COST ALLOCATION, PASSENGER SERVICE, LEVEL 1 AIR CARRIERS, 1989 (1991$)

| | | Seat-km | | | Seat-stages | | | Passenger flights | | | Passenger trips | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Output Units (millions)** | | 75,000 | | | 46 | | | 27 | | | 23 | | |
| | **Expense** | **Alloc-ation** | **Total** | **Per unit** | **Alloc-ation** | **Total** | **Per unit** | **Alloc-ation** | **Total** | **Per unit** | **Alloc-ation** | **Total** | **Per unit** |
| **Air Operations** | | | | | | | | | | | | | |
| Fuel | 1,062.1 | 72% | 764.7 | 0.01023 | 28% | 297.4 | 6.52 | | | | | | |
| Flight crews | 327.1 | 73% | 238.7 | 0.00319 | 27% | 88.3 | 1.94 | | | | | | |
| Landing, insur. | 516.0 | | | | 100% | 516.0 | 11.32 | | | | | | |
| **Air Maintenance** | | | | | | | | | | | | | |
| Labour | 206.6 | 44% | 90.9 | 0.00122 | 56% | 115.7 | 2.54 | | | | | | |
| Materials, other | 425.5 | 44% | 187.2 | 0.00250 | 56% | 238.3 | 5.23 | | | | | | |
| **In-Flight Services** | | | | | | | | | | | | | |
| Cabin crews | 287.5 | 57% | 163.9 | 0.00219 | 43% | 123.6 | 2.71 | | | | | | |
| Food, supp, other | 428.1 | 50% | 214.1 | 0.00286 | 40% | 171.2 | | 10% | 42.8 | 1.60 | | | |
| **Terminal** | 942.0 | | | | | | | 60% | 565.2 | 21.12 | 40% | 376.8 | 16.38 |
| **Marketing** | 1,043.0 | | | | | | | | | | 100% | 1,043.0 | 45.35 |
| **Air Capital** | 512.8 | 44% | 225.6 | 0.00302 | 56% | 287.2 | 6.30 | | | | | | |
| **Total** | **5,750.6** | | | **0.02521** | | | **36.55** | | | **22.72** | | | **61.73** |

costs per seat-stage and seat-kilometre. The analysis did not allow for this.

Fuel was attributed to flight hours, with a small allowance for taxiing. Cabin-crew costs were allocated on the basis of flying hours plus 40 minutes per stage. Maintenance cost and the physical wear of a turbojet airplane are attributed partially to cycles (takeoff, pressurization, de-pressurization, landing) and partially to flying hours. A figure of 40% attributable to cycles (Aviation Planning Associates, 1983) yields estimates of 44% attributable to seat-miles and 56% to seat-stages.

Because most airplane accidents occur at takeoff or landing, insurance, with landing fees, was attributed entirely to these activities. For terminal costs, the only data found that matched the definition used here were old (Bajwa and Shurson, 1981). These were escalated using an approximate construction cost index.

The cost aggregate termed "marketing" includes travel agents' commissions that are generally paid as a percentage of revenue. Using this would introduce a further output unit; however, at the basic level (cost to the agent), passenger-trips would seem a reasonable variable. General and administrative cost, presumably relating to corporate administration, was allocated to all of the preceding items.

Computations for levels 2 and 3 are similar. To convert costs per seat-mile into figures appropriate for comparisons, an average load factor of 67.5% was applied to the Level 1 data. For the connectors/commuters it was estimated as 56%, and for the independent (charter) jet carriers where load factor data were not available, 80% was assumed. It is noted that, perhaps more than any other parameter, the assumption of a uniform load factor distorts route and service comparisons.

System-average costs are calculated by service type as shown in Table 3(2)-10.

*Table 3(2)-10*
*AIR CARRIER AVERAGE UNIT COSTS (IN 1991 DOLLARS)*

| | **Passenger-kilometre ($)** | **Passenger-stage ($)** | **Passenger-flight ($)** | **Passenger-trip ($)** |
|---|---|---|---|---|
| Level 1 | 0.0373 | 54.15 | 22.72 | 61.73 |
| Commuter | 0.0961 | 39.50 | 8.73 | 17.28 |
| Charter jet | 0.0467 | 62.81 | 10.91 | 13.97 |

As an example, the computed average per-passenger cost for a trip from Saskatoon to Halifax (Level 1 carrier) with a change of airplanes in Toronto would be:[45]

| | | |
|---|---|---|
| 3 500 km | at $ 0.0373 | $130.55 |
| 2 stages | at $54.15 | 108.30 |
| 2 flights | at $22.72 | 45.44 |
| 1 trip | at $61.73 | 61.73 |
| | | $ 346.02 |

### 8.3.1 System-Average Domestic Air Trip, 1991

Statistics Canada and the airlines do not keep cost and revenue data for domestic travel. It would not be logical to attempt to keep accounts under that structure; domestic, Canada–United States and international services are operated as an integrated network. The cost characteristics of the different services are, however, quite different. The overseas international services with long average flight and stage lengths, using larger aircraft, differ particularly. To estimate domestic-system-average and system-total costs, a typical trip of 1 478 air kilometres was defined as indicated by Statistics Canada's and other available data. It is noted that these data on flight characteristics are for all airlines (Levels 1 to 3) and for domestic services in isolation; however, the system-average-cost estimate is based on Level 1 carrier cost factors.

|  |  |  |  |
|---|---|---|---|
| Computed carrier cost | 1 478 kilometres | at $0.037 | $55 |
|  | 1.6 stages | at $54 | 86 |
|  | 1.4 flights | at $23 | 32 |
|  | 1 trip | at $62 | 62 |
|  |  |  | $235 |

This yields an average cost of 15.9¢/pass-km to which another $20, or 1.4¢/pass-km, Air Transportation Tax may be added — for a total of 17.3¢/pass-km. The average ticket yield was, however, estimated to be $222 for a trip of this length[46] (15¢/pass-km), or $242 (16.4¢/pass-km) with the Air Transportation Tax. These estimates suggest that the airlines are operating at a loss of 0.9¢/pass-km if one includes a return on capital invested in aircraft.

While these estimation methods are not precise, in the short run it is true that losses are being incurred. It is not, however, reasonable to expect such a condition to persist for very long. To model a more representative steady state condition, it was assumed that the difference will ultimately be made up through price increases averaging approximately 6%.

Special tax/fee costs for air travel consist only of the applicable fuel tax. Royal Commission staff estimate that average fuel consumption for domestic air services is 0.103 L/pass-km. The special tax rate applicable to aviation turbo fuel was 5.8¢/L in 1991. The average tax was therefore 0.6¢/pass-km.[47]

## 8.4 RAILWAY PASSENGER

For practical purposes, when one considers the cost of railway passenger services in Canada, one may limit the consideration to VIA Rail. VIA Rail accounts for 95% of the industry's passenger-kilometres, and the other carriers' unit costs are of the same general order as VIA Rail's. As well, since VIA Rail is exclusively a passenger carrier, no separation of freight from the passenger operations is required in analyzing its data.

The Royal Commission's intercity rail-carrier costing is described in Volume 4 of this report.[48] For the most part, the service costing was based upon VIA Rail's 1990 year-end results. Data for 1989 were available and were used in circumstances where the substantial service rationalization that occurred in January 1990 would have distorted the 1990 results, making them unrepresentative of the longer term.

Overheads and indirect costs included: functional overheads, general corporate overheads, shared facilities and operations, plus the cost of capital on equipment and facilities. The costs used for the year 2000 status-quo costs of Chapter 18 are steady-state in the sense that allowance has been made for improvements in the cost experience of passenger rail.

System-total data for 1991, as shown in Table 3-1 of Volume 1, were estimated from recently available 1991 VIA Rail data, plus escalated 1987 data for BC Rail, and the Algoma Central, Ontario Northland and Quebec North Shore and Labrador Railways. Total Canadian railway passenger revenues and costs, and VIA Rail's share, are:

| | $ million (1991) | | |
|---|---|---|---|
| | VIA Rail | Other | Total |
| Passenger revenue | 144 | 10 | 154 |
| Operations subsidy | 353 | 38 | 391 |
| Depreciation and cost of capital[49] | 62 | included | 62 |
| Total | | | 607 |

Special tax/fee costs for train travel consist of the fuel taxes paid that would be in excess of the normal sales taxes. Average fuel consumption was estimated by Royal Commission staff as 0.043 L/pass-km. Combined with the average special tax-rate on locomotive fuel of 9.5¢/L in 1991, the tax amounted to 0.4¢/pass-km.

## 8.5 FERRY

Cost estimates are based on a research report to the Royal Commission.[50] The report provides cost, revenue and traffic records for the three major ferry corporations: British Columbia Ferry Corporation, Marine Atlantic Inc. and Northumberland Ferries Ltd., which together provide about 95% of Canada's total ferry passenger-kilometres. Estimates of average costs and revenue per passenger-kilometre are developed for these three operations combined and used to represent all domestic intercity ferries. Other intercity services included are the Central Region Ferries in the Great Lakes (Tobermory to South Baymouth) and St. Lawrence (Matane to Godbout; Matane to Baie Comeau; Rivière du Loup to St. Siméon; Trois Pistoles to Les Escoumins), and the Atlantic region service from Souris to the Magdalen Islands. On the other hand, limiting the focus to domestic services means that the service by Marine Atlantic between Yarmouth and Bar Harbor is consequently excluded, as are services such as Victoria to Seattle, Sidney to Anacortes, Victoria to Port Angeles and Yarmouth to Portland.

Costs and revenues are for the fiscal year 1990-91, but are assumed adequate to represent 1991 conditions and 1991 prices. Capital charges were estimated including depreciation and a capital charge on the remaining value of the assets, in a manner similar to that described for air infrastructure. Costs and revenues were estimated per passenger-vehicle-kilometre; that is, vehicle-kilometres by passenger vehicles, as opposed to trucks. These were distinguished by allocating the costs between freight vehicles and passenger vehicles on the basis of space used by the vehicles, measured in "automobile-equivalent" units (an average heavy truck being about three automobile-equivalents). The resulting estimates are:[51]

|  | Costs | Revenues |
|---|---|---|
|  | ($/passenger-vehicle-kilometre) |  |
| BC Ferries | 0.91 | 0.76 |
| Marine Atlantic | 1.98 | 0.85 |
| Northumberland Ferries | 2.28 | 1.01 |

### 8.5.1 Exclusion of Food Services and Other Merchandise Retailing

As for the other modes (in particular airports), costs and revenues attributable to commercial activities other than providing passenger service, and not included in the ticket price, were subtracted from the ferry data. This included cost and revenue related to catering services and other sales of goods. The accounts provided for BC Ferries and Marine Atlantic offer the relevant information (for the former, "cost of food and goods sold" and "catering and other income"; for the latter, "vessel services revenues"). The calculation, in fact, deducts revenue rather than costs, on the assumption that the revenue recovers not only the costs of the materials concerned, but also an appropriate proportion of crew and vessel costs. (This is a tenuous assumption, which probably overstates the costs concerned and so produces a slight underestimation of the remaining transportation costs.)

The arithmetic of removing catering and other sales was:

- For BC Ferries, to estimate them as a proportion of the "ships" costs, and to deduct this proportion from the "vessels" costs per passenger-vehicle-kilometre;
- For Marine Atlantic, to estimate them as a proportion of the "vessels" expenses, and to deduct this proportion from the "vessels" costs per passenger-vehicle-kilometre; and
- For Northumberland Ferries, no information on such costs was available and no deduction was made.[52]

### 8.5.2 Exclusion of Excess Vessel Costs Arising Through Local Construction

Capital cost estimates, and thus total vessel costs, were modified to remove the excess amount incurred through purchasing local construction, as opposed to the lowest-cost (off-shore) alternative. This modification of the estimates of costs is in accordance with the Royal Commission's intention that costs incurred by government in pursuit of non-transportation goals be charged to general revenues — implying that those vessel costs arising from an intention to support Canadian shipbuilders, beyond a level provided by standard import tariffs, should not be included in the costs that users are asked to pay.

The amounts of vessel costs concerned can be estimated only very approximately. From a brief tabulation of some prices paid recently for large ferries in Canada and overseas, it appears that the premium for Canadian construction might be of the order of 50% to 100% of the off-shore price.[53] Some corroboration is provided by comparisons of costs for other types of vessels; for example, a price for construction in Canada of a seaway-size bulk freighter is double that of one built in Korea.[54] To the off-shore prices must be added 25% duty, but the differential remains substantial.

For illustrative purposes, it is assumed that the premium for local construction amounts to 33% of the capital cost of the vessel. This proportion is therefore deducted from the vessel capital costs included in the accounts for Marine Atlantic and BC Ferries. The vessel costs are not separately identified for Northumberland Ferries, so no such deduction is made; but the effect of this omission on the system average costs is negligible.

The resulting costs per passenger-vehicle-kilometre, amended for both food services (cost and revenue) and local vessel construction premiums, are:

| | Costs | Revenues |
|---|---|---|
| | ($/passenger-vehicle-kilometre) | |
| BC Ferries | 0.73 | 0.62 |
| Marine Atlantic | 1.74 | 0.71 |
| Northumberland Ferries | 2.28 | 1.01 |

### 8.5.3 Estimation of Costs per Passenger-Kilometre

The earlier cost and revenue estimates attempted to exclude all elements relating to freight transportation. In estimating the costs per ferry passenger-kilometre for comparison with the other modes, it is necessary to distinguish the passengers on ferries who travel in passenger vehicles from the occupants of freight vehicles, who are also described as passengers in the ferry statistics. Assuming 1.1 occupants per commercial vehicle, there were 637,000 passengers in commercial vehicles, or 2.8% of the total of some 22.8 million passengers in 1990-91, for the three companies. Because the commercial vehicle passengers are so small a proportion of total passengers, the subsequent estimate of total passenger-kilometres is clearly not very sensitive to the guessed number of occupants per commercial vehicle.

For BC Ferries and Marine Atlantic, this procedure for estimating "non-commercial passenger-kilometres" was applied to each of the services, allowing overall estimates of 640 million passenger-kilometres for BC Ferries and 135 million passenger-kilometres for Marine Atlantic. For Northumberland Ferries, the amended estimate is 12.07 million passenger-kilometres. Expressed alternatively as numbers of passengers per passenger-vehicle carried by the three companies, the results are as shown in the second column of Table 3(2)-11. The cost and revenue estimates in the previous tables can be divided by these estimates of passengers per vehicle to give costs and revenues per "non-commercial passenger-kilometre" in the final two columns of Table 3(2)-11.

*Table 3(2)-11*
*AVERAGE FERRY UNIT COSTS AND REVENUES*

| | Passengers per passenger-vehicle | Costs ($ pass-km) | Revenues ($ pass-km) |
|---|---|---|---|
| BC Ferries | 2.59 | 0.282 | 0.239 |
| Marine Atlantic | 2.43 | 0.718 | 0.292 |
| Northumberland Ferries | 2.48 | 0.921 | 0.408 |
| Average | | 0.366 | 0.250 |

The system-average vehicle/carrier cost estimate for ferries is therefore 36.6¢/pass-km, and the "user-borne" portion is 25¢/pass-km.

In the illustrative tables of Volume 1, Chapters 3 and 18, amounts borne by vehicle users/carriers and passengers for accident costs and special transportation taxes/fees are shown separately. In the case of ferries, all of these costs are included in the estimated averages of 36.6¢/pass-km and 25¢/pass-km; thus, they must be deducted to show the remaining vehicle/carrier costs.

### 8.5.4 Estimation of Special Tax/Fee for Ferry

As the first step in the calculation of special taxes, the amount of fuel used in the ferry services must be estimated per passenger-kilometre. Marine Atlantic provided data for the company's fuel purchases and expenditures over a three-year period.[55] Direct estimates of fuel used by BC Ferries and Northumberland Ferries were not available; estimates based on their expenditures on fuel[56] in 1990, together with an assumed average price of 26.5¢/L plus provincial tax, were used. These estimates suggest a combined total fuel consumption of about 195 million litres for the three ferry companies.

These estimates of consumption were then allocated between freight and passenger vehicles for each company in the same manner as were costs; that is, according to proportions of auto-equivalent units transported. Then the estimates of total (non-commercial) passenger-kilometres for the three companies were used to calculate litres of fuel consumed per passenger-kilometre. The resulting estimate is 0.191 L/pass-km.

The average special tax payable per litre for these ferry services was then calculated. This involved a calculation analogous to that for the special tax component of prices of gasoline used in cars, as discussed earlier. Federal excise and provincial fuel taxes paid, by province, in 1991, on marine fuels are shown in Table 3(2)-12. The amount of provincial tax that would have been payable had the normal sales tax rate been applied to the price of marine fuel was then calculated — also shown in Table 3(2)-12. Finally those amounts were deducted from the total of the federal excise and provincial taxes paid to obtain the net amounts of special transportation tax paid.

*Table 3(2)-12*
*SPECIAL TAX CALCULATION: FERRY*
*(TAXES IN 1991¢/L OF MARINE FUEL)*

| | Nfld. | P.E.I. | N.S. | N.B. | B.C. |
|---|---|---|---|---|---|
| Federal excise | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Provincial tax | 0.0 | 0.0 | 1.2 | 0.0 | 3.34 |
| Tax at PST rate | 3.9 | 3.3 | 3.3 | 3.6 | 1.5 |
| Net special tax | 0.1 | 0.7 | 1.9 | 0.4 | 5.8 |

To estimate the amounts of fuel used in the east-coast services bought in each province, it is simply assumed that half the fuel used in each of the ferry services is purchased at each end of the trip. The weighted average tax rate paid on the Marine Atlantic services would then be 0.96¢/L, on Northumberland Ferries' services 0.55¢/L, and on the BC Ferries' services, as shown in Table 3(2)-12, 5.8¢/L.

Then, by multiplying these taxes by the estimated consumption per passenger-kilometre, the average special fuel tax payment for all the ferry services is estimated as 0.87¢/pass-km. This is included in the system-wide costs in Table 3.1, appearing as 0.9¢/pass-km when rounded.

The amount of this tax must be deducted from the vehicle/carrier costs together with ferry accident costs, estimated at 0.075¢/pass-km. Resulting user-borne vehicle/carrier costs are reduced from the 25¢/pass-km estimated earlier, to 24.1¢/pass-km, while total vehicle/carrier costs are reduced from 36.6¢/pass-km to 35.7¢/pass-km.

## 9. COSTS FOR SAMPLE ROUTES

### 9.1 CAR

For simplicity, in these illustrations most of the costs of car use are assumed to be constant per kilometre, regardless of route. In reality, vehicle fuel consumption would differ among the routes, being determined by such factors as travel speed and the extent of congestion. Vehicle maintenance and depreciation per kilometre would also vary by those factors, and be influenced by the quality of the highway pavement. Accident risks and, therefore, expected accident costs, are also known to vary by route and traffic conditions. Nevertheless, it is assumed here that such variations are not important to the major purpose of these estimates, which is to show the orders of difference in costs by mode, and subsequently (in Chapter 18) to show the future cost changes expected. Each of these classes of costs is therefore assumed to be the same per vehicle-kilometre on all of the sample routes as the system-wide averages estimated earlier. Also for simplicity, and in the absence of much information, average vehicle occupancies are assumed constant for all sample routes, so these categories of costs remain the same per passenger-kilometre as the system-wide averages.

The exceptions are the highway infrastructure costs and the environmental costs, which are assumed to vary by route, as described in subsections 9.1.1 and 9.1.2.

### 9.1.1 Costs of Infrastructure

The estimates of highway construction and maintenance costs prepared by Nix et al. and shown in Table 3(2)-3, earlier, differ substantially by class of highway. Adding the cost of capital to those estimates, and inflating to 1991 prices, produces the costs per vehicle-kilometre, which appear in the second column of Table 3(2)-13(i). The proportions in which each class of highway are represented differ among the sample routes, so the average infrastructure cost should also differ by route. The proportions have been estimated only roughly by Royal Commission staff. The estimates made for the four sample routes in Volume 1, Chapter 3 and also for the additional routes in Chapter 18, are as shown in part (i) of Table 3(2)-13.

Part (ii) of Table 3(2)-13 then shows the resulting estimates of costs averaged over the highway types for each of the routes, expressed as costs per vehicle-kilometre and per passenger-kilometre. It can be seen that they differ substantially, being lowest for the all-expressway route between Toronto and Montreal and greatest for the predominantly low-density rural highway route between Winnipeg and Gillam.

The estimates of car infrastructure costs for the sample routes are produced by adding the system-average cost of infrastructure control per passenger-kilometre from subsection 5.1.4., of 0.22¢/pass-km, to the costs per passenger-kilometre in Table 3(2)-13. In addition, for the route from Toronto to Montreal an estimate of the highway land cost of 0.3¢/pass-km, or $1.60 per passenger-trip, is included. Land costs are ignored on the other routes, as they are expected to be much less important within the trip totals.

Table 3(2)-13

## HIGHWAY CONSTRUCTION AND MAINTENANCE COSTS FOR SAMPLE ROUTES, INCLUDING COST OF CAPITAL, IN 1991 PRICES

| (i) Costs per vehicle-km, and route distance by class of highway | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Costs (¢/veh-km) | | Assumed distance on sample routes by highway type | | | | | | |
| | | | Toronto–Montreal | Saskatoon–Halifax | Val d'Or–Montreal | Vancouver–Toronto | Winnipeg–Gillam | Halifax–St. John's | |
| Highway class | Car | Bus | (km) | (km) | (km) | (km) | (km) | via Port aux Basques (km) | via Argentia (km) |
| Expressway | 1.091 | 1.955 | 539 | 1,300 | 114 | 1,360 | 0 | 110 | 110 |
| Paved highway: | | | | | | | | | |
| – top 10% | 1.626 | 3.048 | 0 | 1,592.5 | 0 | 1,566 | 200 | 578.5 | 179.5 |
| – middle 30% | 3.933 | 7.754 | 0 | 1,592.5 | 336 | 1,566 | 875 | 578.5 | 179.5 |
| – bottom 60% | 10.486 | 20.980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total route distance** | — | — | **539** | **4,485** | **450** | **4,492** | **1,075** | **1,267** | **469** |

**Sources: Costs by highway type from estimates by Nix et al., including capital charges estimated by Royal Commission staff, and inflated to 1991 prices. Route distances by highway type estimated by Royal Commission staff.**

*Table 3(2)-13 (cont'd)*

### HIGHWAY CONSTRUCTION AND MAINTENANCE COSTS FOR SAMPLE ROUTES, INCLUDING COST OF CAPITAL, IN 1991 PRICES

| **(ii) Average costs by car and bus for sample routes** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Toronto–Montreal** | **Saskatoon–Halifax** | **Val d'Or–Montreal** | **Vancouver–Toronto** | **Winnipeg–Gillam** | **Halifax–St. John's** | |
| **Highway class** | | | | | | **via Port aux Basques** | **via Argentia** |
| **Car costs:** | | | | | | | |
| Average cost/veh-km (¢) | 1.091 | 2.290 | 3.213 | 2.268 | 3.504 | 2.633 | 2.383 |
| Average cost/pass-km (¢) | 0.627 | 1.316 | 1.846 | 1.304 | 2.014 | 1.513 | 1.370 |
| **Bus costs:** | | | | | | | |
| Average cost/veh-km (¢) | 1.955 | 4.402 | 6.285 | 4.358 | 6.878 | 5.102 | 4.593 |
| Average occupancy (pass/veh) | 36.19 | 27.00 | 21.15 | 27.00 | 21.15 | 20.00 | 20.00 |
| Average cost/pass-km (¢) | 0.054 | 0.163 | 0.297 | 0.161 | 0.325 | 0.255 | 0.230 |

**Source: Bus occupancy by route estimated by Royal Commission staff.**

### 9.1.2 Environmental Costs

As well as differing because of trip lengths, costs of environmental damage are expected to differ among the illustrative routes because of the different distances travelled within the ozone non-attainment areas (ONAs). In fact, because fuel consumption, and implicitly other engine operating conditions, are assumed constant among the routes, emissions are also constant per vehicle-kilometre. The cost for $CO_2$ (at 3.27¢/kg, as described in the Notes to Chapter 7 in this volume) is therefore also constant per vehicle-kilometre for all routes, at about 0.73¢, or 0.41¢/pass-km.

The cost of emissions of $NO_x$ and VOCs, however, is assumed to be $5/kg only within the ONAs, and only during summer. Otherwise the cost is zero. The portion of each of the sample routes assumed to lie within the ONAs is shown in Table 3(2)-14, for the other modes as well as for car travel. Emissions per vehicle-kilometre are assumed constant during each trip; therefore, the proportion of trip-kilometres within the ONAs represents the proportion of trip emissions within those areas. The fraction of emissions that occur in summer is assumed to be constant at 40%. That portion of the total $NO_x$ and VOCs emissions on each route in ONAs in summer is multiplied by $5/kg to obtain the cost for each route.

A more comprehensive explanation of the derivation of the costs on two of the sample routes, Toronto to Montreal and Saskatoon to Halifax, forms part of the Notes to Chapter 7 in this volume.

## 9.2 BUS

### 9.2.1 Costs of Infrastructure

The costs for highway construction and maintenance per bus-kilometre estimated by Nix et al., in Table 3(2)-3, also differ substantially by class of highway, and therefore vary among the sample routes as the types of highways represented differ. Distances by class of highway are assumed to be as described for cars, shown in Table 3(2)-13(i).

Table 3(2)-14

### TRIP DISTANCES BY MODE, AND DISTANCES IN OZONE NON-ATTAINMENT AREAS FOR SAMPLE ROUTES

| | Toronto-Montreal | | Saskatoon-Halifax | | Val d'Or-Montreal | | Vancouver-Toronto | | Winnipeg-Churchill | | Halifax-St. John's | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | via Port aux Basques | | via Argentia | |
| | km | km in ozone non-attainment areas | km | km in ozone non-attainment zones | km | km in ozone non-attainment zones | km | km in ozone non-attainment zones | km | km in ozone non-attainment zones | km | km in ozone non-attainment zones | km | km in ozone non-attainment zones |
| Car | 539 | 539 | 4,485 | 650 | 450 | 114 | 4,492 | 250 | — | — | 1,267 | 0 | 469 | 0 |
| Bus | 539 | 539 | 4,485 | 650 | 450 | 114 | 4,492 | 250 | — | — | 1,267 | 0 | 469 | 0 |
| Train | 540 | 540 | 4,468 | 400 | 700 | 200 | 4,467 | 250 | 1,375 | 0 | — | — | — | — |
| Airplane[a] | 496 | 100 | 3,500 | 100 | 425 | 50 | 3,365 | 100 | 1,000 | 0 | 875 | 0 | 875 | 0 |
| Ferry | — | — | — | — | — | — | — | — | — | — | 178 | 0 | 519 | 0 |

Source: Royal Commission staff estimates.

a. Airplane kilometres in "ozone-sensitive areas" assumed to be 50 km per trip-end within such areas.

The second column shows the costs per vehicle-kilometre for buses by class of highway.

Part (ii) of the same table shows the weighted average cost per bus-kilometre over each route. As for cars, the lowest cost per vehicle-kilometre is incurred over the expressway route between Toronto and Montreal, and the highest over the low-density rural highway route between Winnipeg and Gillam.

The table then shows, in the next-to-last row, the Royal Commission staff estimates of average bus occupancies over routes of these types, and the last row shows the average cost per passenger-kilometre by route, obtained by dividing the cost per vehicle-kilometre by the occupancy on each route.

### 9.2.2 Environmental Costs

Emissions of $CO_2$, $NO_x$ and VOCs from buses are assumed to be constant per litre of fuel used, as described in the Notes to Chapter 7 in this volume. They therefore vary per vehicle-kilometre by route only to the extent that fuel use per vehicle-kilometre varies, and also vary per passenger-kilometre to the extent that bus occupancies differ.

Fuel use per bus-kilometre is estimated by Royal Commission staff to be constant at 40 L/100 bus-km on most of the sample routes. Occupancies are assumed to vary by route as was shown in Table 3(2)-13(ii). The resulting fuel use per passenger trip for buses is shown in Table 3(2)-15, which also includes fuel use in the other modes. Emissions by route are obtained by converting the fuel use into $CO_2$, $NO_x$ and VOCs emissions by the factors implicit in Table 7(2)-1 and 7(2)-2, which appear later in this volume.

Then costs of the emissions by route are calculated as described above for cars. Total trip emissions of $CO_2$ are multiplied by the assumed cost of 3.27¢/kg. Emissions of NOx and VOCs are first multiplied by the portion of trip-kilometres in the ONAs, also shown in Table 3(2)-15, and by 40% to represent summer; then remaining emissions are multiplied by $5/kg.

*Table 3(2)-15*

### FUEL USE PER PASSENGER-TRIP BY MODE ON SAMPLE ROUTES

| | Toronto–Montreal | | Saskatoon–Halifax | | Val d'Or–Montreal | | Vancouver–Toronto | | Winnipeg–Churchill | | Halifax–St. John's | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | via Port aux Basques | | via Argentia | |
| | L/pass | % in ozone non-attainment areas | L/pass | % in ozone non-attainment zones | L/pass | % in ozone non-attainment zones | L/pass | % in ozone non-attainment zones | L/pass | % in ozone non-attainment zones | L/pass | % in ozone non-attainment zones | L/pass | % in ozone non-attainment zones |
| Car | 27.0 | 100 | 224.3 | 14 | 22.5 | 25 | 224.6 | 6 | — | — | 63.4 | 0 | 23.5 | 0 |
| Bus | 5.9 | 100 | 67.0 | 14 | 8.6 | 25 | 67.0 | 6 | — | — | 23.0 | 0 | 8.0 | 0 |
| Train | 15.0 | 100 | 283.3 | 9 | 102.9 | 29 | 270.0 | 6 | 260.0 | 0 | — | — | — | — |
| Airplane[a] | 40.8 | 69 | 219.2 | 16 | 46.3 | 60 | 120.0 | 23 | 80.8 | 0 | 67.2 | 0 | 53.8 | 0 |
| Ferry | — | — | — | — | — | — | — | — | — | — | 34.4 | 0 | 100.3 | 0 |

**Source:** Royal Commission staff estimates.

[a] Airplane fuel use in takeoff/landing assumed to be 35 litres per passenger.

## 9.3 TRAIN

### 9.3.1 Costs of Infrastructure

The infrastructure costs, as for the carrier costs, are taken from data provided by VIA Rail and Transport Canada. Infrastructure costs are presumed to be payments to the freight railways for the service in question.

### 9.3.2 Environmental Costs

Emissions are assumed to be constant per unit of diesel fuel energy, as shown in Table 7(2)-1 in this volume. Estimated diesel-fuel use per passenger-trip for each sample route is shown in Table 3(2)-15. The two are combined to give emissions of $CO_2$, $NO_x$ and VOCs per passenger-trip. Total $CO_2$ emissions are multiplied by a cost of 3.27¢/g. Costs of $NO_x$ and VOCs are calculated by applying the unit cost of $5/kg to the portion of emissions released in the ONAs (from the trip-kilometres in ONAs in Table 3(2)-15) in summer (40%).

## 9.4 AIRPLANE

### 9.4.1 Costs of Infrastructure

The allocation of air infrastructure costs to individual sample routes is illustrated in subsection 5.3.3 of this Chapter.

### 9.4.2 Environmental Costs

Emissions are again assumed to be constant per unit of fuel energy among the sample routes, at rates shown in Table 7(2)-1 of this volume. Estimates of fuel use per passenger-trip are provided in Table 3(2)-15. The two are combined to give emissions of $CO_2$, $NO_x$ and VOCs per passenger-trip.

Total $CO_2$ emissions are multiplied by a cost of 3.27¢/g. Amounts of $NO_x$ and VOCs occurring in the ONAs are calculated somewhat differently for aircraft than for the other modes. Instead of using the proportion of route-kilometres that lies within the ONAs, it is assumed that the aircraft fuel used on the ground, climbing and descending at airports within the ONAs contributes to low-level ozone, while fuel used at cruising altitude does not. The relevant amount of fuel (for aircraft of a Level 1 carrier) is estimated by Royal Commission staff to be about 35 litres per passenger-stage. The proportion this represents of fuel used per passenger-trip by route is shown in Table 3(2)-15. This proportion of trip emissions, multiplied by 40% to represent summer, is multiplied by $5/kg to obtain the $NO_x$/VOCs cost per passenger-trip.

## 9.5 FERRY

No route-specific ferry costs are shown in Chapter 3, but 1991 costs for ferry routes are included in Chapter 18. The examples in Chapter 18 are of the two ferry routes between Nova Scotia and Newfoundland. Costs per passenger-kilometre for infrastructure and accidents are assumed to be the same as the system average.

### 9.5.1 Vehicle/Carrier Costs

Costs for the two routes are obtained from the research report that provided the system-average costs.[57] The same procedures described earlier for the system-average costs were used to remove costs of food services and excess vessel costs arising from local construction, and to estimate fuel costs and taxes in order to distinguish the special tax/fee for the routes.

### 9.5.2 Environmental Costs

Emissions are again assumed to be constant per unit of fuel energy, as shown in Table 7(2)-1. Fuel use on the two illustrative ferry routes is assumed to be the same per ferry-kilometre, and per passenger-kilometre, and therefore differs per passenger-trip only by route length, as shown in Table 3(2)-15. No costs for $NO_x$ and VOCs are assessed on either of these routes, as their emissions are assumed to occur entirely outside the ONAs.

# ENDNOTES

1. Cross subsidy, in this context, implies that the hypothetical service in question makes more than the average contribution to fixed cost. Most economists would not use this (implied) definition of cross subsidy.

2. Estimates developed from Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215, 1989; bus fuel consumption data; bus company accounts; and assumed load factors.

3. Treasury Board of Canada, *Benefit-Cost Analysis Guide* (Ottawa: Supply and Services Canada, 1976).

4. There are two methods of accounting for capital costs: investment expenditures can be included in total costs in the year in which they are made, or they can be amortized over time in such a way that the stream of annual "depreciation charges" and of annual "interest charges" (or return on capital) has the same discounted present value as the initial investment expenditure. The latter approach gives a smoother stream of annual costs and provides a better estimate of the cost of using the facility in a particular year. The Royal Commission's cost analysis work uses this amortized cost approach; a real rate of return of 10 percent, applied to one-half the replacement value of the facility, is used to estimate the "interest charge."

5. F. P. Nix, M. Boucher and B. Hutchinson, "Road Costs," in Volume 4 of this report.

6. Ashish Lall, "Transportation Infrastructure Costs in Canada," in Volume 4 of this report.

7. Z. Haritos, *Rational Road Pricing Policies in Canada* (Ottawa: Canadian Transport Commission, 1975), and Strategic Policy Directorate, Transport Canada, *Transport Costs and Revenues in Canada* (Ottawa: Transport Canada, July 1982).

8. The term "expressway" is used to denote a limited access highway.

9. An alternative means of estimating the capital value of the highway stock would be creating average lifetime profiles of costs of construction and repair per kilometre for highways of various qualities, and combining them with estimates of the age profiles of various parts of the network. The necessary unit costs — particularly of costs of new construction of highways of various qualities — and age profiles are not available. Some possible indication of the relevant amounts can be obtained using costs of reconstruction from the report by Nix et al., "Road Costs," to represent costs of new construction (which understates construction costs by the amounts needed for preparation, grading, drainage, etc.). By adding resurfacing and reconstruction costs as also indicated by that report, lifetime profiles of costs by type of highway can be created. Then, assuming highways are of average age (that is, that construction was spread evenly over the last 45 years or so), the following current capital values can be estimated:

| | | $ million (at 1989 prices) |
|---|---|---|
| Expressways | | 1,860 |
| Paved rural highways | top 10% | 1,630 |
| | middle 30% | 4,160 |
| | bottom 60% | 7,920 |
| Total | | 15,600 |

A capital charge at 10% on that total would amount to $1.56 billion per annum. When allocated by vehicle type by passenger car equivalent units, this charge per passenger kilometre for an average car/light truck would amount to approximately 0.5¢/pass-km.

This method would produce the same cost as does the guesswork in the text — that is, close to 1¢/pass-km — if the true unit costs of new construction (per kilometre) were about double those drawn from Nix et al. for reconstruction. It seems quite probable that new construction costs are that much higher.

10. J. J. Lawson, "Available resources for efficient accident prevention," in *III$^e$ Congrès Mondial de la Prévention routière internationale* (PRI) (Luxembourg: PRI, 1989), pp. 34–47.

11. Pilorusso Research & Consulting Inc., "The Cost of Inter-City Travel by Private Motor Vehicle," a report prepared for the Royal Commission on National Passenger Transportation, RR-05, August 1991.

12. Deliberately ignoring the tolls on international bridges, recognizing that the costs of those bridges do not appear in provincial/federal roads budgets, and are therefore not included in our costs.

13. British Columbia Ministry of Transportation and Highways, *Annual Reports*, 1988–89 and 1989–90.

14. Personal communication, British Columbia Ministry of Transportation and Highways.

15. Maximum gross weight quoted for "B-train double," with exceptions being in Ontario and Yukon, where the limit is 63.5 tonnes. See Council of Ministers of Transportation and Highway Safety, Interjurisdictional Committee on Vehicle Weights and Dimensions, *Summary of Weight and Dimension Regulations for Interprovincial Operations, Resulting from the Memorandum of Understanding on Interprovincial Weights and Dimensions*, September 1989 (available from Canadian Council of Motor Transport Administrators, Ottawa).

16. Nix et al., "Road Costs."

17. Ibid., from Table E.6, average obtained from weighting by vehicle-kilometres by class of highway, and inflating from 1989 to 1991 prices at 4.5% per year.

18. The equivalent standard axle load of a candidate vehicle or axle is defined as the number of passes of a "standard axle load," of 18,000 lb. (8 163 kilograms) on a single axle supported by four tires, required to create the same amount of damage as one pass of the candidate axle load. In customary form ESALs have been calculated from the "fourth-power law" of pavement damage. See Nix et al., "Road Costs," subsection 2.3.3.

19. See subsection 5.1.2. for the derivation of capital costs for cars. Allocating 40% to 60% of the total highway capital stock of $59 billion to highways, and 25% (by PCE-kilometres) to heavy trucks, applying an annual capital charge of 10%, and averaging over 16 billion vehicle-kilometres gives 3.7¢ to 5.5¢/veh-km.

20. F.P. Nix, *Road-User Costs*, Report TP 9766 (Ottawa: Transport Canada, April 1989).

21. As noted in the report by Nix et al., "Road Costs," use of the cost formula with "Waterloo Load Equivalency Factors" instead of ESALs would raise the estimated cost per vehicle-kilometre by some 40% to 50%.

22. It should be noted that the estimates of what are referred to as "marginal pavement costs" in the report by Nix et al. are not directly comparable, either in units of measurement or in concept, with the conventional definition of marginal cost of pavement wear. The latter refers to the cost of wear associated with passage over the pavement of one truck. The report investigated the way in which capital construction costs plus the present discounted value of resurfacing costs over the life of the highway vary with traffic volume, including volume of heavy truck traffic, assuming road and pavement structure are optimal given the traffic volumes. Thus, the report's "marginal pavement cost" represents the estimated increase in discounted life-cycle investment expenditures (a capital stock concept not an annual cost) as the average annual traffic volume increases. Further, the report does not directly address the issue of estimating truck wear on existing highways that may not be optimally matched to traffic volume.

23. Sypher : Mueller International Inc., *Air Infrastructure Costing*, a report prepared for the Royal Commission on National Passenger Transportation, RR-04, August 1991.

24. For the eight largest sites (Dorval and Mirabel are considered as one) or major federal airports (MFAs), which were part of the now discontinued Airports Revolving Fund, financial statements are produced on an annual basis, which conforms to generally accepted accounting principles. The statements are contained in a publicly available document produced each year by Transport Canada entitled "TP 1300 Airports Revolving Fund, Financial Statements for the year ended 19_ _".

    For the next 14 largest sites, which were once part of the Airport Revolving Fund and are now known as federally dependant airports (FDAs), annual financial statements are produced by the site financial officers and submitted to the Financial Advisor of the Airports Group at headquarters. Although these statements are not published or audited like the MFA sites, copies can be obtained through headquarters personnel and represent a reasonably accurate source of site costs and infrastructure.

    For the remaining sites, which are also classified as FDAs, financial statements are not prepared on an annual basis and are only available on a timely basis when Transport Canada undertakes special studies to update the Department's historical financial data base. A complete update of this data base was last undertaken for the fiscal year 1987-88.

25. Costs have been allocated to three user groups — commercial, instrument flight rules (IFR) general aviation (ga), and visual flight rules (VFR) ga. Commercial includes unit toll, charter, and other commercial operations. Unit toll is defined as the transport of people or goods on a toll or price per person or unit. Charter is the transport of a person or good for a price to hire the aircraft per kilometre or hour. Other commercial operations include flights performed by commercial aircraft other than the unit toll or charter services. IFR ga includes itinerant movements of operators using radio navigation instruments to assist the pilot. VFR ga includes itinerant and all local movements of operators not using radio navigation instruments. In general terms, IFR ga tends to use larger, more sophisticated aircraft, while VFR ga tends to use smaller aircraft.

26. See D. Gillen and T. H. Oum, "Transportation Infrastructure Policy: Pricing, Investment and Cost Recovery," in Volume 3 of this report.

27. No readily accessible source of data was available for the replacement cost of Transport Canada's fixed assets; however, historical book value and accumulated depreciation were available on a site-specific basis.

    To develop a reasonable proxy for capital charges based on replacement value for each site the accumulated depreciation was divided by the average annual depreciation expense to estimate the average life of the asset base. From this, an average original year of expenditure for the base was calculated. This original year was then used to determine the cost-escalation factor based on the Statistics Canada's Implicit Price Index for Total Construction, which was applied to the original book value to restate it in terms of 1990–91 dollars. If the asset base increased by more than 20% in any one year, the amount of the expenditure was removed from the cost base and inflated by the factor that corresponded to the year of the expenditure.

28. Transport Canada, *1989–90 Estimates: Part III, Expenditure Plan* (Ottawa: Supply and Services Canada, 1989).

29. On a movement allocation basis, this would be: 4 movements at $42.54 + 3 500 kilometres at $0.15 = $695. Divided among a typical 85 passengers, this amounts to $8 per passenger.

30. Charles Schwier and Richard Lake, "VIA Rail Services: Economic Analysis," in Volume 4 of this report.

31. Statistics Canada, *Rail in Canada, 1989*, Catalogue No. 52-216, 1991.

32. Transport Canada, *Proposed New Cost Recovery Policy: Phase II Discussion Paper*, Report TP 10041 (Ottawa: April 1990), Table 14, updated with values for fiscal year 1990–91 by personal communication from Economic Evaluation and Cost Recovery Directorate, Transport Canada.

33. Most of the estimates of the willingness-to-pay for risk reductions are expressed as values per death avoided, when the risk reductions involve reductions in both deaths and injuries. It is not then appropriate to add to the material losses from injuries a further value for willingness-to-pay to avoid emotional losses through injury. The value of the material losses is therefore used for injured victims, $10,000 per victim.

34. Only in a minority of accident cases is there a court determination of compensation. Other cases settled out of court might include compensation for emotional losses, and in a larger number there is some nominal payment based on the insurance contract. Compensation in all such cases is unlikely to be as great as the cost inferred from the willingness of users to pay for risk reductions.

35. Pilorusso Research & Consulting Inc., *The Cost of Inter-City Travel.*

36. Statistics Canada, *Passenger Bus and Urban Transit Statistics, 1989*, Catalogue No. 53-215, 1992.

37. Tax rates in 1992 for intercity buses are, for example, $522 for a bus with a gross weight as high as 20 000 kilograms in Ontario, and $522 in Saskatchewan for any bus with more than 25 seats.

38. Richard Lake, L. Ross Jacobs and S. T. Byerley, "An Analysis of the Canadian Intercity Scheduled Bus Industry," in Volume 4 of this report.

39. The Canadian bus industry records its data in imperial units.

40. Airline Cost Information Sources

Aviation Planning Associates, *Analysis of Elements of Direct Operating Costs of Canadian Air Carrier Jet Aircraft* (Canadian Transport Commission, Research Branch, 1983).

Aviation Planning Associates, *Direct Operating Costs Comparison of DHC-7 and DHC-8 with Competitive Aircraft* (Canadian Transport Commission, Research Branch, 1982).

M.A. Bajwa, *Direct Operating Cost Comparison of DHC-7 & Competitive Aircraft* (Canadian Transport Commission, Research Branch, 1974).

M.A. Bajwa and G. Shurson, *A Study of Mainline and Regional Air Carriers' Terminal Handling Costs* (Canadian Transport Commission, Research Branch, 1981).

M.A. Bajwa and G. Wilson, *An Analysis of Canadian Air Carriers' Operating Costs* (Canadian Transport Commission, Systems Analysis Branch, 1974).

CTC Research, *Inflation and the Canadian Airline Industry* (Canadian Transport Commission, Research Branch, 1984).

R. Fosbrooke, *A Study of the Incidence of Cross-Subsidy in the Canadian Airline Industry* (Canadian Transport Commission, Research Branch, 1980).

J. Gibberd, *Airline Costing: An Introduction* (Canadian Transport Commission, Research Branch, 1985).

J.A. Greig, *The Low-Priced Air Fare Review: The First Five Years* (Canadian Transport Commission, Research Branch, 1983).

J. Greig, and R. Fosbrooke, *Nature of Operating Costs, in Study of Competition in the Canadian Airline Industry: Cost Structure* (Canadian Transport Commission, Research Branch, 1979).

D.B. Laprade, *The Basic Economics of Air Carrier Operations* (Canadian Transport Commission, Research Branch, 1981).

J.C. Moloney, *Air Canada's Domestic Economy Fare Formula and Its Relationship to Average Domestic Scheduled Costs* (Canadian Transport Commission, Research Branch, 1986).

R. Roy, *Economies of Scale in the Airline Industry* (Canadian Transport Commission, Research Branch, 1980).

Roger Roy and Diane Cofsky, *A Productivity Study of Canadian Air Carriers* (Canadian Transport Commission, Research Branch, 1984).

R. Roy, and R. Fosbrooke, *Joint and Common Costs for Major Carriers, in Study of Competition in the Canadian Airline Industry: Cost Structure* (Canadian Transport Commission, Research Branch, 1979).

41. For the purpose of this analysis, an airplane (or seat or passenger) stage is defined as a take off and a landing. A flight may involve additional takeoffs and landings (intermediate stops) but with a single flight coupon and not normally a change of airplane. A trip may include multiple flights but is not broken for purposes other than onward connections.

42. Statistics Canada Catalogue No, 51-005, 51-204 and 51-206 for 1988, 1989 and 1990; Air Canada and PWA Corporation Annual Reports for 1988, 1989, 1990 and 1991 (PWA only).

43. This is a more restrictive definition than that used to estimate the cost of an average domestic trip later in this section. Any change of airline, even to an affiliated carrier, or from domestic to international flights, is counted as an additional passenger trip in the Statistics Canada data, which was partially used to develop this model.

44. As these data were quite uncertain, given the variety of sources, a variant of the model to test the sensitivity of the unit cost estimates to these parameters — particularly the number of flights in the average trip — was run. An assumption of 1.35 flights per trip — more than doubling the assumed proportion of multi-flight trips — resulted in increases in estimated vehicle/carrier cost for the sample routes that ranged from 2.5% for Saskatoon–Halifax to 6.5% for Toronto-Montreal. In the context of the Royal Commission's analyses, this is not significant.

45. The pass-km and stage-km elements of the cost would be more accurately computed using the actual load factors for the stages involved, if these were known. For the present purpose — portrayal of typical cost — the system average Level 1 figure is more appropriate.

46. Inflated from data presented in S. A. Morrison, "Deregulation and Competition in the Canadian Airline Industry," in Volume 4 of this report.

47. As was shown in Table 3(2)-8, combined federal and provincial aviation turbo fuel taxes net of provincial sales tax vary from 0.6¢/L in Newfoundland and 1.3¢/L in Nova Scotia to 9.1¢/L in Saskatchewan. A system-average special tax/fee rate of 5.8¢/L was calculated as a weighted average of consumption of aviation turbo throughout the country. Inasmuch as the system average is calculated for all aviation consumption, it may not be entirely accurate for domestic, as opposed to international, services. A greater source of uncertainty applies to the route-specific estimates. These are based on the assumption that the quantity of fuel consumed during each stage travelled is taxed in the jurisdiction where that stage commences. In the case of Halifax–St John's, the assumed special tax/fee shown is therefore very low, and the tax for a seat-stage taking off from Saskatoon has been assumed to be high. Of course, aircraft do not always take on fuel before every takeoff, or in the exact quantity to be consumed during the succeeding stage. Subject to overriding safety considerations, airlines manage their fuel acquisition to minimize their costs of operation, of which fuel cost — including taxes — is an important element.

48. Charles Schwier and Richard Lake, "VIA Rail Services: Economic Analysis," in Volume 4 of this report. (See Section 3, Rail Passenger Cost Model and Appendices A, B and C.)

49. Capital charges include depreciation and a 10% cost of capital, and assume that all assets are 50% depreciated.

50. Geoplan Consultants Inc., *Canadian Ferry Costs and Industry Analysis*, a report prepared for the Royal Commission on National Passenger Transportation, RR-09, December 1991.

51. Ibid., costs from Tables 5.1 and 5.2, and revenues from Tables 6.1 and 6.2.

52. The total costs concerned would be too small to have other than a negligible effect on estimated average costs.

53. Geoplan, *Canadian Ferry Costs*, Table 8.1.

54. The Research and Traffic Group, *The Great Lakes and St. Lawrence Seaway System: Commercial Attractiveness and Priorities for Policy Development*, report prepared for the Marine Office, Ontario Ministry of Transportation, 1990.

55. Geoplan Consultants Inc., Marine Atlantic Background Information 1988–1990, a working paper prepared for the Royal Commission on National Passenger Transportation, 1991.

56. Geoplan, *Canadian Ferry Costs*, Tables 4.3 and 3.2, respectively.

57. Ibid.

# ANNEX 1: OPPORTUNITY COST OF HIGHWAY LAND

An attempt is made here to estimate the amount of land occupied by the highway network, and its opportunity cost, in terms of value in reasonable alternative use.

## ROUTE-KILOMETRES BY PROVINCE

The lengths of highways are obtained from the annual statistical publication of the Transportation Association of Canada.[1] The estimated route-lengths by province are shown in Table 3(2)-A1, and total 8 220 km of expressway and 129 016 km of paved rural highway.

## AREA OF LAND DEDICATED TO HIGHWAYS

The width of land used for expressways varies substantially depending on the nature of the terrain and surrounding land use, as well as the number of lanes, widths of medians, shoulders, and so on. It is assumed for simplicity that the average width of the right-of-way for conventional four-lane rural expressways is 100 m. This is believed generous — leading again to a possible slight over-estimate of land use. For two-lane rural highways, the standard width of right-of-way is 100 feet (30.5 m).

A simple calculation then allows an estimate of the total area of land taken by expressways as 82 000 hectares, and of that occupied by rural highways as 393 000 hectares, for a total of 475 000 hectares. Provincial estimates are also shown in Table 3(2)-A1.

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[1] In recent years, for example, Transportation Association of Canada, *Highways in Canada: 1991 Report*, (Ottawa: TAC, 1991), these figures have been presented only in "equivalent two-lane kilometres," but estimates of the route-kilometres are possible by reference to the publication for 1985, Roads and Transportation Association of Canada, *Roadway Infrastructure Study* (Ottawa: RTAC, 1987). For "paved rural roads" it is reasonable to assume that two-lane kilometres are identical to route-kilometre, as the 1985 publication showed the former to be less than 2% greater than the latter (and this assumption will therefore produce a very slight over-estimate of land costs). For expressways, the adjustment is more important, as the difference between two-lane kilometre and route-kilometre is shown by the 1985 publication to be large, and to differ substantially by province. The particular assumption made here is that the average freeway is four lanes, with the exceptions of Quebec and Nova Scotia, for which the 1985 publication showed that the expressways had fewer lanes than the national average. It has been assumed for both provinces that the 1985 highways still exist, and that all expressway-kilometres added since that date have been of four-lane standard.

*Table 3(2)-A1*

### AREA AND VALUE OF LAND USED FOR PROVINCIAL EXPRESSWAYS AND HIGHWAYS, 1990

| | B.C. | Alta. | Sask. | Man. | Ont. | Que. | N.B. | N.S. | P.E.I. | Nfld. | All provinces |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Expressways: | | | | | | | | | | | |
| – route-km | 427 | 1,232 | 24 | 0 | 1,882 | 3,200 | 110 | 1,300 | 0 | 45 | 8,220 |
| – rural hectares | 4,227 | 12,197 | 238 | 0 | 18,632 | 31,680 | 1,089 | 12,870 | 0 | 446 | 81,378 |
| – urban hectares | 43 | 123 | 2 | 0 | 188 | 320 | 11 | 130 | 0 | 5 | 822 |
| Other highways: | | | | | | | | | | | |
| – route-km | 20,554 | 12,907 | 10,299 | 6,878 | 16,419 | 36,245 | 4,400 | 11,804 | 3,408 | 6,102 | 129,016 |
| – rural hectares | 62,022 | 38,947 | 31,077 | 20,755 | 49,545 | 109,370 | 13,277 | 35,619 | 10,284 | 18,413 | 389,308 |
| – urban hectares | 626 | 393 | 314 | 210 | 500 | 1,105 | 134 | 360 | 104 | 186 | 3,932 |
| All highways: | | | | | | | | | | | |
| – rural hectares | 66,249 | 51,144 | 31,315 | 20,755 | 68,176 | 141,050 | 14,366 | 48,489 | 10,284 | 18,858 | 470,686 |
| – urban hectares | 669 | 517 | 316 | 210 | 689 | 1,425 | 145 | 490 | 104 | 190 | 4,754 |
| – total hectares | 66,919 | 51,661 | 31,631 | 20,964 | 68,865 | 142,475 | 14,511 | 48,979 | 10,388 | 19,049 | 475,441 |
| Rural value/hectare ($) | 1,198 | 788 | 516 | 642 | 2,644 | 1,053 | 808 | 872 | 1,453 | 1,527 | 1,223 |
| Urban land value/ hectare ($) | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 | 370,645 |
| (i) Value of total hectares as farmland ($M) | 80 | 41 | 16 | 13 | 182 | 150 | 12 | 43 | 15 | 29 | 581 |
| (ii) Value of rural hectares as farmland, and urban hectares for housing ($M) | 327 | 232 | 133 | 91 | 435 | 677 | 65 | 224 | 53 | 99 | 2,338 |

**Sources: Route-km from Transportation Association of Canada.**
**Farmland values from Statistics Canada.**
**Urban residential land values derived by Royal Commission staff from house prices provided by Canada Mortgage and Housing Corporation.**

## OPPORTUNITY COST OF THE LAND

In attempting to identify this opportunity cost, it is tempting to look at the market prices commanded by equivalent land close by. But this is subject to a conceptual criticism: surrounding land use can be substantially altered by the existence of the highway. In general, the accessibility provided by the highway generates more surrounding activity than otherwise, and raises the market value of the surrounding land.

For the rural land used for highways in Canada, this concern is probably not of practical importance. One can probably simply look to the use of the land prior to the highway being built, or consider what the use would revert to if the highway were scrapped, and come to a similar conclusion about the realistic opportunity costs. If there were only local access (through the grid road system), the land would probably be usable only for some form of agriculture or forestry, or might not be suitable for either and remain unused. No information is available to estimate which portions of Canadian highways would revert to each of these purposes, nor are details available of actual land prices by location, from which it might be possible to estimate values of land used for specific highways. The average prices of farmland by province, however, are available, and are shown in Table 3(2)-A1.[2] Such averages are province-wide, and might represent land on average that is even more remote from settlements than the land used for highways. On the other hand, these prices are for the portions of land that are usable for farming, when much of the land on which highways are constructed would likely otherwise be too poor for farming, and worth even less. These prices for farmland can be used as an indication of the alternative value of land used for highways, in the expectation that they probably overestimate the true opportunity costs.

The complexity is greater for urban land occupied by highways. Accessibility increases the value of the adjacent land. Therefore the opportunity cost of the highway land should not be represented by the market value of adjacent land, but more reasonably by that of equivalent land that does not have the accessibility advantage from the highway. It could be difficult, if not impossible, to identify such "equivalent land," without some other accessibility advantage. Again, the logical test might be the value that the land could command if the highway were entirely abandoned. It seems reasonable to assume that the land would otherwise be served simply by local access streets, and be usable for residential or commercial purposes comparable with land similarly served in the community concerned.

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[2] Personal communication from Agriculture Division, Statistics Canada, February 1992.

For illustrative purposes, it is assumed that the alternative use would be for residential purposes, with value equal to the average price of land for new house construction for the entire cities concerned (therefore reflecting the total accessibility advantages gained from the communities' transport connections, but with no premium from direct proximity to any particular connection).

Estimates of average new detached/semi-detached house prices in 1991 were obtained from Canada Mortgage and Housing Corporation (CMHC).[3] The appropriate national average of residential land prices is elusive, as CMHC does not provide estimates of new house prices for all of the communities on the national network. Instead, one can only guess at the relevant price from the averages for those larger communities that are provided. These show that the average new house price in 1991 among the 25 largest metropolitan areas was $197,000, of which approximately 30% is the land component, or about $59,000. Among the 52 largest communities, the value was $149,000, and the land component[4] at 30% amounted to approximately $50,000. These communities feature prominently in the primary highway network, but so do a much larger number of smaller communities.

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[3] In personal communications between Royal Commission staff and staff from Statistics Division of CMHC, Feb. 27,1992.

[4] Information provided by Statistics Canada and CMHC by city suggests that the land proportion of the total house price is surprisingly constant at nearly 30%, when total prices ranged between $109,000 and $305,000 among the cities covered. As the information is compiled from reports made by builders, it is possible that they are using a simple rule-of-thumb of 30% in their responses.

Furthermore, those land values are for serviced land and for detached houses. The average value for urban land occupied by highways is probably therefore substantially lower. For illustration, an average value is assumed of $30,000 for a lot of 4,000 square feet (370 $m^2$). With five lots per acre (or, more than 12 per hectare), allowing for services, this suggests values of unserviced land of about $150,000 per acre, or $371,000 per hectare, in 1990 prices.

The area of urban land involved is not large as a proportion of total land used for highways, but, as will become obvious in the examples that follow, the precise amount and its value is crucial to the estimate of the total value of the land used. No record is available of the length of the urban portions of the highway system; that is, those portions that, in the costing scheme, are assumed to displace residential land rather than farmland. It seems certain that the proportion cannot be as much as 5% (1 km in 20, or 7 000 km of the entire 140 000 km of primary highways being in urban areas), and more likely is closer to 1% (1 km in 100, or 1 400 km in total). A proportion of 1% of the highway system will represent urban portions.

## RESULTS OF ALTERNATIVE ESTIMATES

### Alternative Value as Farmland

Table 3(2)-A1 shows the value that the road network would have if the only alternative use of the entire system was as farmland. Using the average farmland prices provided by Statistics Canada, the 82 200 hectares of expressways would be worth $111 million, and the 393 000 hectares of 2-lane highway would be worth $470 million, giving a total for the whole system of $581 million.

### Alternative Rural Value as Farmland, Urban Value for Housing

Table 3(2)-A1 also shows estimates for the opportunity costs of the land if 99% of it is rural, usable for farming, and the other 1% is in urban areas, usable for residential development. The essential assumptions from above are:

| | |
|---|---|
| • Expressway right-of-way width | 100 metres |
| • Paved 2-lane highway right-of-way width | 100 feet |
| • Proportion of all highways in urban areas | 1% |
| • Average price of urban residential land per unserviced hectare | $370,000 |

The urban portions of the highway network have an estimated value of $1.8 billion. The total value of the urban and rural systems is now estimated at $2.4 billion. The importance of the assumptions about the area and value of the urban portions can be appreciated, as the rural part of the network, while 99% of the total length of the system, has an alternative value at farmland prices of $570 million, only 24% of the total value.

It is judged that this latter estimate, including urban land valued by its potential alternative development, is more appropriate than valuing the entire land as farmland. The estimate is therefore converted to a cost per passenger-kilometre, as follows.

### Estimated Opportunity Cost of Land per Passenger-Kilometre

In order to compute these land costs per unit of traffic, the capital value of the land is converted into an annual sum, using a real rate of 10% per year as the opportunity cost rate.

Land costs are then allocated between private passenger and other vehicles according to the number of "passenger-car-equivalent-kilometres" they contribute annually. As noted earlier, this procedure allocates some 70% of costs to cars/light trucks in passenger use.

Also as noted earlier, annual traffic on the highway network by cars and light trucks in passenger use is estimated as 120 billion vehicle-kilometres, and 210 billion passenger-kilometres.

The results of the computations are as follows:

| | |
|---|---|
| Total capital cost of land | $2,400 million |
| Annualized cost at 10% | $240 million per year |
| Annualized cost attributable to cars | $170 million per year |
| Cost per passenger-kilometre | $0.0008 |

In conclusion, using the base-case assumptions, the total land value is estimated as approximately $2.4 billion, which, when annualized at real interest rate of 10% in perpetuity produces a value of approximately 0.08¢/pass-km. Given the uncertainty in this estimate, it is incorporated in the highway infrastructure cost estimates, rounded to 0.1¢/pass-km.

# ANNEX 2: OPPORTUNITY COST OF AIRPORT LAND

The dimensions of the nine major federal airports, together with the latest appraisals (by purpose) of the land available at each of the sites, were made available by Transport Canada,[1] and are shown in Table 3(2)-A2. The appraised values are for actual parcels of land on the airport property available for the specified uses. Objective appraisers (usually Public Works Canada) rate the property based on its characteristics and comparisons with land used for similar purposes in the immediate area.

*Table 3(2)-A2*

*APPRAISED VALUE OF LAND AT MAJOR FEDERAL AIRPORTS, 1991, BY PURPOSE*

| | Size | Value appraised per square metre, by type of use | | | | | |
|---|---|---|---|---|---|---|---|
| | (hectares) | Light industrial with air-side access ($) | Light industrial ($) | Commercial ($) | Heavy industrial with air-side access ($) | Heavy industrial ($) | Agricultural ($ per hectare) |
| Halifax | 951 | 30 | — | 36 | — | 17 | (870)[a] |
| Mirabel | 6,920 | 28-35 | 23–28 | 32–82 | 12–24 | 10–20 | 1,400 |
| Dorval | 1,668 | 75 | 45 | 100 | — | 25 | — |
| Pearson | 1,715 | — | 68–79 | 124 | — | 50 | — |
| Ottawa | 2,086 | — | 78–90 | 100–120 | — | 40 | — |
| Winnipeg | 1,504 | 35 | — | 40 | — | 30 | — |
| Edmonton | 2,800 | 21 | — | — | — | 20 | 2,700 |
| Calgary | 1,839 | 43 | — | 50 | — | 38 | — |
| Vancouver | 2,800[b] | — | 86–109 | — | — | — | — |

a. **Appraised value not provided by Transport Canada, so instead the figure is the average value for farmland in Nova Scotia estimated by Statistics Canada, Agriculture Division.**

b. **1 000 hectares assumed available for alternative development, to preserve wetland.**

It can be seen that land for "commercial" purposes has the highest value: this would be land with excellent access — probably on an arterial road — with potential for development of shops, hotels, and so on. It is therefore a very limited proportion of the land on any airport site, and its appraised value is probably dependent on the traffic attracted by the airport. As such, it is inappropriate as a measure of the opportunity cost of the airport land, that is, value in alternative use if the airport were not there.

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[1] Personal communication between Royal Commission staff and staff of Transport Canada Airports Group, March 1992.

The light and heavy industrial land designated as "with air-side access" is close enough, and on direct roadways to the air-side land, so that it could be used for services for the airlines and aircraft. ("Light industrial" use would include hangars, flight kitchens, fuelling, de-icing; "heavy industrial" use would be rare, including, for example, oil tank farms.) Such land therefore has a premium value over industrial land without air-side access, which can presumably be used only for the same purposes as equivalent land outside of the airport. The appraised value of this land without air-side access therefore gives an indication of the value of the land in industrial use if the airport were not there.

The appraised values of land for agricultural use are clearly much lower than values for the other purposes. Much airport land is apparently usable for farming, and large parts of some airports are currently leased for it — particularly Edmonton, but with sizeable portions also of Calgary and Winnipeg airports.

The appraised values do not include residential use as a current option, but it should be considered in seeking the opportunity cost of the land. Abandonment of the airports (or shifting them to more remote locations) could make available large tracts of land close enough to the centres of some cities that they would be attractive for residential purposes. Even though some of the sites are surrounded by light industrial or heavy-industrial activities, they are sufficiently large that they could be developed as residential enclaves.

In fact, they could become very large residential developments. Table 3(2)-A3 shows the number of houses that could be built on some of the airports, if there were only about 12 houses to the hectare (five to the acre) — which assumes only about half the available land would be house-lots, with the rest used for services, institutions, and so on.

About 20,000 houses could be built on the land area of each of Dorval, Pearson or Calgary airports, about 25,000 on Ottawa's site, or about 35,000 on that in Vancouver. Table 3(2)-A3 also shows the value of this land at the average price estimated for the relevant cities (estimated as described earlier for the value of highway land, assuming serviced land accounts for 30% of new house prices, obtained from Canada Mortgage and Housing Corporation).

*Table 3(2)-A3*
*Value of Airports if Developed for Residential Use, 1991*

| | **Number of houses at 12 per hectare (approx)** | **Value of residential land ($ per hectare)[a]** |
|---|---|---|
| Dorval | 20,000 | 300,000 |
| Pearson | 20,000 | 900,000 |
| Ottawa | 25,000 | 400,000 |
| Calgary | 22,000 | 500,000 |
| Vancouver | 32,000[b] | 700,000 |

a. **Based on estimated values per serviced lot provided for cities from Canada Mortgage and Housing Corporation; reduced by $10,000 per lot as a rough allowance for servicing.**

b. **Only 1 000 hectares assumed available for development.**

If entirely used for residential development, the areas of Pearson and Calgary airports would apparently be worth more than for light industrial use, at about $1.5 billion and $0.9 billion respectively. The sites at Ottawa ($0.8 billion), Vancouver ($0.7 billion) and, in particular Dorval ($0.5 billion) would, by these simplistic calculations, apparently be worth less in residential than in light industrial use.

It should be noted also that these developments would be so large that they would certainly affect the price of housing, and residential land, even in the three largest cities. They might be impractically large, depressing prices so much that the development would only be viable if spread over many years. In cities of the size of Ottawa or Calgary it would certainly not be viable to add so much housing in the short term (25,000 houses would probably add 15% to 25% to the total number existing in Ottawa). Therefore it is probably unreasonable to assume residential development as the opportunity use of the entire area of any of the major federal airports.

For illustrative purposes, Table 3(2)-A4 shows the hypothetical value of the area of each of the airports in possible alternative use. The estimates are very rough, given the uncertainties in the estimated average values per unit of land by purpose, and particularly the reasoning on alternative uses. The reasoning is as follows:

- The sites at Halifax, Mirabel and Edmonton are sufficiently distant from other centres of activity that the possibility of attracting industrial or commercial activity to fill their sites is remote, and farming seems the more reasonable option (and even that might be optimistic for Halifax, or for the entire site of Mirabel).
- For the other airports, it seems likely that some portion of the land could find alternative light industrial use. For Ottawa, Winnipeg and Calgary, the airport areas would add so much land to that available for light industrial use within those cities that it would be very unlikely that the whole area would be developed. There is substantial land available of similar quality, at similar distances from the city centres in each of those communities. It is assumed that 25% of the areas of these airports could be sold at the current price for light industrial land (or, more precisely, that at each of the sites a value equivalent to the current price multiplied by 25% of the surface area could be realized if an attempt to sell the entire area was made).
- For Dorval and Vancouver it is assumed that land so accessible to the city is in sufficient demand that most or all of their usable surface could be turned to light industrial use. The amount of land concerned would still be a significant addition to total light industrial land available even in those regions, so it can be expected that making these tracts available would lower the market price, to some extent. To allow for the interaction of the amount available and its price, it is assumed that the maximum value obtainable from these sites is 50% of their surface area[2] multiplied by the current price — representing, for example, being able to find buyers for 50% of the area at current prices, or lowering the price by 50% in selling the entire space immediately.

---

[2] It is also assumed that only 1 000 hectares of the Vancouver site would be available for development, the remainder being conserved.

- For Pearson, it is assumed that the alternative use is residential, and that a value equivalent to 50% of the current lot price could be realized if the entire surface area was sold.

*Table 3(2)-A4*

*OPPORTUNITY COSTS OF LAND AT MAJOR AIRPORTS, 1991*

| Airport | Estimated land values ($ millions) |
|---|---|
| Halifax | 1 |
| Mirabel | 10 |
| Dorval | 400 |
| Pearson | 750 |
| Ottawa | 440 |
| Winnipeg | 130 |
| Edmonton | 8 |
| Calgary | 200 |
| Vancouver | 500 |
| **Total** (rounded) | **2,500** |

**Value of Land at Other Airports**

Transport Canada has also provided the surface areas of another 87 airports (without any information on their appraised values). The land used for many minor airports has little opportunity cost, in that equivalent unused land is available close to many of the cities and towns concerned. On the other hand, similar land, close to the larger centres, could be very valuable in alternative use. To represent the possibilities, without any site-specific information, it has been assumed for the 20 next-most-important airports, comprising "Class III" in the study for the Royal Commission of airport costing,[3] that the average value of the land at these sites is half the average for the seven Class II major federal airports (that is, the nine airports in Table 3(2)-A4 except Pearson and Vancouver, which form Class I). From the above analysis, the average value per hectare for those seven was $67,000. The average assumed for the next 20 is therefore $33,500 per hectare. Their total area is 12 319 hectares, so the total is $411 million. Added to the median value of the nine major airports, the total then becomes $2.9 billion.

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[3] Sypher : Mueller International Inc., *Air Infrastructure Costing*, a report prepared for the Royal Commission on National Passenger Transportation, RR-04, August 1991.

For all remaining airports, the value of the land is assumed to be negligible (especially given the margin of error in the above estimate).

### Annualized Value of the Land

The total capital value estimated above is about $2.9 billion. Using a real rate of 10% per year as the opportunity cost rate for capital assets, this land cost is estimated at $290 million per year.

### Land Value per Passenger-Trip, and Passenger-Kilometre

Averaged over a total of 62,813,444 enplaned/deplaned (E/D) passengers at all airports in 1988, the total land value would then amount to some $4.60 per passenger. For the illustrative costs in 1991, this is rounded up to $5 per E/D passenger, or $10 per stage. Averaged over the representative air trip of 1 478 km with 1.6 stages, it amounts to 1.08¢/pass-km, included in the system-wide average costs as 1¢/pass-km.

# NOTES TO CHAPTER 6: RAIL INFRASTRUCTURE ISSUES

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# 1. RUNNING RIGHTS AND JOINT TRACK USAGE

This section provides a more extended discussion of existing arrangements under which one railway company uses another railway company's track, as a supplement to the subsection of Chapter 6 in Volume 1 entitled "Improving Access to Rail Tracks."

## 1.1 GENERAL

Running rights and joint operations have a long history both in Canada and elsewhere, and are considered by some to be residual customs from early railway development in England. Today, sharing sections of track owned by another railway company is both common and beneficial. Running rights and joint operations not only provide railway companies with access to another company's lines, but can also provide alternative transportation services for railway customers. In Canada, with its difficult geography, such alternatives are very important — when a railway's track is temporarily closed through accident or for major maintenance, trains are routinely routed over a competitor's line.

In some instances, the sharing of facilities is brought about by the need to connect two pieces of track. At the root of this sharing is a desire to avoid unnecessary duplication of railway facilities. Running rights can permit a railway company without its own track to operate successfully. Although it does have small track holdings, VIA Rail essentially operates in this way.

There is a technical difference between running rights and joint operations (or joint track usage). A railway company may have the right to operate trains over the tracks of another railway without any reciprocal (running rights) privilege for the second railway. Joint operations (joint track usage) involve railways sharing facilities in order to improve service or to avoid the duplication of facilities. In Canada, situations range from the example of one railway operating trains for a few hundred feet using another's tracks in order to connect to its own track (running rights), to the proposal that CN and CP jointly use track in the Fraser River canyon. This proposal was made (but never implemented) 10 years ago[1] when double digit traffic growth was forecast.

Running rights and joint track usage complicate the technical operation of a railway. This is most obvious where freight and passenger services are combined. The problem is largely one of operating logic (and perhaps union agreements, where crews are paid on the basis of distance rather than time). Passenger trains accelerate faster and generally operate at faster speeds than freight trains. Also they are usually given higher priority. Problems with scheduling and signalling, especially road crossing protection, can be encountered.

In Canada at the moment, perhaps the most complex operational situation exists between Hamilton and Toronto, where one double-track line serves CN, CP, VIA Rail and GO Transit. This example falls somewhere between the simple running rights example and the Fraser River canyon example, and could be considered joint operations, since the construction of duplicate facilities has been avoided.

## 1.2 LEGISLATION AND REGULATION

### 1.2.1 Canada

Legislation concerning access to trackage of another company has been in the *Railway Act* for many years[2] and remained largely unchanged from the 1919 Act until the proclamation of the *National Transportation Act, 1987* (NTA, 1987).[3] When the NTA, 1987 was drafted, most of the provisions concerning the use of facilities belonging to another railway were taken from the *Railway Act* (section 134) and placed in Part III, Division I of the NTA, 1987, which only deals with freight (see Annex 1). Previously, section 134 of the *Railway Act* had applied to both freight and passenger rail; however, section 94 of the *Railway Act* (1970) remains intact (renumbered section 98) and provides for running rights or joint track usage if the directors of the respective companies agree.[4] The regulatory body's power to order a railway to permit a passenger operator on its lines appears to have been removed, since section 98 (formerly 94) merely provides for agreement by the respective carriers.

The NTA, 1987, section 148 provides for mandatory running rights. Reviewing how it has been applied (for freight) is instructive. The National Transportation Agency recently granted an organization that owns no track (known as MOQ Rail[5]) the status of a railway company under section 11 of the *Railway Act* as amended in 1987. The requirement for this status is similar to that for freight motor vehicle undertakings — a certification of fitness. In May 1990, MOQ Rail applied to operate under the provisions of the NTA, 1987, section 148, over CN lines between Moncton, New Brunswick, and Windsor, Ontario. Tests for a prototype operation (prior to certification under the *Railway Safety Act*) were planned; however, MOQ's application was withdrawn when CN purchased 50% of the company.

### 1.2.2 United States

In the United States, if Amtrak can demonstrate the need to operate over a section of line and can demonstrate that the line is inadequate for passenger operations, the Interstate Commerce Commission (ICC) can require the owning railroad to sell the line to Amtrak for an amount set by the ICC under the provisions of the *Rail Passenger Services Act of 1970* (45 USC 562(d)). As of early 1992, a case was pending before the U.S. Supreme Court that challenged the ICC's enforced sale to Amtrak of a line owned by Guildford Transportation, which owns and operates the Boston and Maine and the Maine Central Railroads. In this instance, Amtrak upgraded the line and then sold it to one of Guildford's competitors.

When Amtrak was established, several lines in the northeastern United States were conveyed to it, while in other areas, it operated over shared facilities. For example, Amtrak at one time operated through the Detroit to Windsor tunnel without paying for the use of the facilities and ran over the Canada Southern (then controlled by

ConRail) across southern Ontario to Niagara Falls. It picked up and carried Canadian passengers between Canadian points and did not pay for the use of the Canada Southern line. It neither sought nor received formal authority from the Canadian Transport Commission to operate on that [illegible] Furthermore, the tunnel was a subsidiary of the Canada Southe[illegible] Canadian company. Amtrak subsequently terminated the service and CP and CN purchased the Canada Southern, the tunnel and the railway bridge at Niagara Falls.

With respect to freight operations in the United States, the ICC has often ordered joint facility usage, especially in yards, when mergers have taken place. Running rights and access to yard facilities have been ordered to ensure that a railroad can connect its various segments of track, and that it can reach connecting carriers.

## 1.3 COMPENSATION

Canadian statutes are silent on the matter of compensation. There are several accepted methods of compensating a railway for the use of its facilities, and these are largely determined by the type of usage made and the privileges accorded to the user railway. There does not appear to be any impediment to two parties developing their own method of compensation based on the nature of the agreement.

In the simplest example — of using a very short stretch of track — the compensation normally consists of installing and paying for the connection(s) and sharing the maintenance costs of the short section of track. In other circumstances, if the host railway only permits the user to run over its line without picking up or delivering freight or passenger traffic, compensation normally consists of what is known as wheelage — that is, a fixed amount per car or locomotive that runs over the line. If the user is allowed to solicit business along the host line, compensation may be a percentage of the revenue generated by the user railway (for example, CP's arrangements for running over CN lines between Port Colborne and Welland).

## 2. BENEFITS AND COSTS OF GREATER SPECIALIZATION IN TRACK USE FOR FREIGHT AND PASSENGER SERVICES ON THE TORONTO–OTTAWA–MONTREAL TRACK NETWORK — A PRELIMINARY ANALYSIS

The subsection of Chapter 6 in Volume 1 entitled "Should a Separate Rail Track Agency be Public or Private?" notes the possibility of rationalizing track use in the Toronto–Ottawa–Montreal triangle. Chapter 18 notes that faster service on some passenger rail routes might be an element of development of some viable rail services. One suggestion presented to the Royal Commission was that dedicating one of the existing Toronto to Montreal rail lines to passenger rail might allow significant improvements in train speed, especially if accompanied by some track upgrading. The Royal Commission did not attempt any thorough evaluation of this suggestion — such an evaluation is the task of managers of passenger rail operations who, under the Royal Commission's framework, would have the main responsibility for judging whether such initiatives might be commercially viable. Some preliminary analysis, however, was carried out that may be of interest to those concerned with passenger rail possibilities.

This note considers the potential for the three class-1 railways — CN, CP and VIA Rail — to reorganize their infrastructure to deliver better rail services, and to do so more efficiently, through consolidating freight operations on one of the main line systems and dedicating the other to passenger service or, more likely, optimizing it to the requirements of passenger service. Any such change would require line upgrading and there could also be regulatory requirements to overcome.

### 2.1 GENERAL CONCEPT

Achieving a substantial degree of specialization of the intercity track in the Toronto–Ottawa–Montreal triangle in either freight or passenger operations might require a single track authority. This note, however, does not concern itself with such possible institutional reform, but rather explores cost aspects of greater specialization in track use that would be relevant whatever the institutional arrangements.

From the passenger service point of view, potential benefits would arise out of:

(a) redistribution of the freight traffic on the existing lines so as to provide one Toronto to Montreal route that could be "optimized" for intermediate speed passenger operations; and

(b) any further arrangements that would help minimize the extent to which competing freight and passenger traffic were at odds.

The concept, as examined here, is not necessarily designed to result in one of the two principal rail rights-of-way becoming a "passenger-only" line, with all of the freight being shifted to the other line. The creation of a passenger-only track — especially using the present CN's Lakeshore route — could result in significant freight access problems and harm to local industry. Rather, the focus is on a system where one route would be optimized for, and carry, the passenger traffic and the other optimized for, and carry, most of the freight.

## 2.2 REQUIREMENTS FOR A UNIFIED SYSTEM OF TRACK

To achieve a workable collective or separated track operation, a blend of technical and operational changes would be necessary.

On the technical side, the CN and CP Toronto to Montreal tracks would need to be connected in four or more locations to allow reasonably convenient access from the northern, predominantly freight track (the present CP mainline) to freight yards and shippers to the south (on the present CN line). There would need to be fully automated, interlocked crossovers that allowed movement between the tracks at reasonable speeds. There are many points where such crossovers could be located. (See subsection 2.3.)

The second major technical change would be a requirement for an integrated signal, train control, and dispatching system for the two tracks, which could be tied into the individual CN and CP systems at each end. The integrated control system should not present insurmountable difficulties, especially since both railways have shown serious interest in the implementation of Advanced Train Control Systems (ATCS).

Other issues needing resolution would include redefining crew districts and seniority systems to reflect the different routing some of the freight trains may take, plus training freight train crews for the additional route. Both railways have successfully negotiated such issues in the past as a result of other structural changes in the railway system. It would also be necessary to develop some changes in the way liability for accidents is assessed. Again, CN, CP and VIA Rail have operated with running rights over parts of other railway systems and have developed methods of dealing with the issue.

Another issue that must be addressed is the capacity of the one route — in this discussion, the CP track — to efficiently handle the additional freight traffic displaced from the other route. In general, the capacity appears to exist, but there could be degradation of express-train trip times — which both CN and CP may find unacceptable for market reasons. Additional siding capacity would be needed on the single-track section between Toronto and Smiths Falls. Without simulation of the train configurations and dispatch times, it is difficult to predict the extent of the additional capacity requirements.

## 2.3 FREIGHT ACCESS

The development of satisfactory freight access from the present CP mainline to the present CN Lakeshore track seems possible at the cost of investing in new connections. Freight access is not as much of an issue on other segments of the "triangle." VIA Rail is the only user of, and has purchased, the Smiths Falls to Ottawa segment of the track. Between Brockville and Smiths Falls there is presently very little freight traffic, and this is unlikely to interfere with the passenger trains. On this segment, most passenger delays are due to the transition between the two routes at Smiths Falls. Thus, greater specialization of track use, in itself, could not be expected to be of any significant benefit to the passenger system; a by-pass or new connecting tracks would be required to make any noticeable improvement. (This has not been included in the notional cost estimates that appear later.)

On the Ottawa to Montreal route (CN's Alexandria Subdivision), there is little opportunity to provide alternative freight access for local traffic. The line also carries Ottawa to Montreal freight trains and some freight trains between western Canada and Montreal. There is alternative routing from the Lakeshore track to Ottawa via the CP Prescott Subdivision, and traffic from western Canada can be rerouted via CP's mainline through Smiths Falls.[6]

It should also be noted that VIA Rail presently owns most of CP's old M and O Subdivision right-of-way that runs from Ottawa to Dorion. The track has been removed from this route. While this would be a straight and direct route for passenger service, it would require new track at substantial cost.

## 2.4 BENEFITS OF REDUCED FREIGHT INTERFERENCE

It is sometimes suggested that reducing the number of freight trains on the Lakeshore track could create a significant benefit in improved passenger trip times since there would be less interference between freight and passenger trains. This is not likely to be the case. First, much of the CN freight traffic is scheduled at night and other times when there are no passenger trains, and some daytime freight trains do not operate on an express schedule, instead waiting for the passenger trains. Second, the Lakeshore route is a full double-track system with a significant siding capacity, which reduces freight and passenger interference.

In overall terms, our investigations suggest that there is little freight interference delay built into VIA Rail's present express-train times between Toronto and Montreal. If anything, there may be more interference between individual passenger trains at station stops.[7] Other potential interference between the freight and passenger systems is more incidental and can be eliminated or reduced without restricting the number of freight trains.[8] On average, reducing freight-passenger interference by restricting the number of freight trains on the Lakeshore route could only shorten the passenger-trip time by a few minutes — because mainly through-freight (which interferes little) could be shifted to the CP route, and the present level of way-freight activity (which interferes more) would continue.

Of more benefit may be the potential for greater schedule flexibility (arrival and departure times) that might be gained through reducing the number of freight trains on the Lakeshore route. However, this type of freight and passenger interference often takes place in urban areas and at other points where geography limits the potential for reducing the number of freight trains. For example, eastbound CN freight access from the Montreal yard over the Victoria Bridge to the Maritimes appears to be one of the governing factors in the scheduling of passenger trains into and out of Montreal's Central Station. Given the importance of the timeliness of these trains to the Halifax container terminals, competing against Montreal and U.S. rivals, there is only limited flexibility here.

## 2.5 BENEFITS OF HIGHER SPEED LIMITS

Given the present demands on the transportation system, greater potential benefits from the creation of a "passenger-optimized" Toronto to Montreal route may result from raising the passenger train speed limit. At present, with a mix of freight and passenger trains — operating over level crossings at quite different speeds — the passenger train speed limit is 95 mph (153 km/h). Steps that might be taken to improve passenger train trip times include adjusting crossing signal timings to safely allow higher speed operation through grade crossings, and resetting curve super-elevations more in line with passenger train speeds.

How much and what type of freight remains on the passenger-optimized line will be important. Assuming that higher speed operation through grade crossings is considered reasonable — Amtrak allows 110 mph (177 km/h) operation through grade crossings in the Northeast Corridor — it would be necessary to reset all of the grade-crossing protection circuits to provide the necessary warning time at higher speeds. Presuming some freight traffic is to be retained, it would be advantageous to provide some form of "smart" grade-crossing circuits that would detect the difference in train speeds and provide the appropriate warning time. (Imposing a long wait on motorists for a slow freight train undermines crossing signal credibility, and encourages motorists to take risks.) The technology for smart grade crossings is available, but its installation could be expensive.

Resetting curves would allow passenger trains to negotiate them at a higher speed, but curves cannot be fully optimized for passenger service if freight traffic is to be continued. While there are curves on the Lakeshore route, it is not overly curvaceous. Thus, the potential gains in trip time will be limited. On the other hand, if one were prepared to wait, the cost of resetting curves would be modest, since much of this work could be carried out as part of the routine and scheduled track maintenance programs.

In terms of the signal system itself — for protecting following and opposing train movements — preliminary investigations do not suggest that much additional investment would be required to allow higher passenger train speeds within the range that is being considered. It appears that present block lengths and stopping distance allowances would be sufficient to allow 105 mph (170 km/h) or higher operation in many of the non-urban areas of the Lakeshore route.

How much time could be gained on a Toronto to Montreal trip? VIA Rail's present best trip time with an F-40 locomotive and four LRC cars is 4 h 10 min with an intermediate stop only at Dorval. For every 5 mph (8 km/h) gain in the average achievable speed in the non-urban areas (roughly Pickering to Dorval), approximately 10 minutes could be taken off the trip time. A 20-minute improvement in trip time might be achievable — perhaps a bit more — without substantial investment (more than estimated in subsection 2.6). In addition, there appear to be other modest investments that would result in a savings of trip time. What is not at all clear is how much of the overall time savings may be achievable within the present context, and how much might require the shifting of freight traffic.

An important issue in improving train speeds on the Lakeshore route that is often overlooked is the capabilities of the rolling stock itself. The LRC locomotive has been tested to speeds as fast as 125 mph (200 km/h), although neither CN nor VIA Rail would want to operate such a heavy locomotive at that speed. The newer F-40s have been cleared to operate at 95 mph (153 km/h). It is not known how much more speed can be gained from this equipment. What is clear is, however, that going to much higher speeds would require the shortening of the trains or adding a second locomotive. Under present circumstances, the addition of even one car to a four-car LRC-powered train would result in a noticeable performance degradation if run to VIA Rail's fastest schedule. The potential need for more powerful locomotives, or for a second locomotive unit, will have to be included in any analysis of the gains from increased speed. In many cases, the second locomotive may already be available in the present (or projected) fleet to handle peak train sizes; it simply is not used on days when demand dictates a shorter train.

## 2.6 NOTIONAL CAPITAL COSTS FOR AN INTEGRATED SYSTEM

In terms of infrastructure investment, costs of a general order of $60 million would be required to interconnect the two systems substantially to allow ease in rerouting intercity freight trains and faster passenger-train operation. The following are the types of investment required:

*Table 6(2)-1*

*COST OF INVESTMENTS FOR AN INTEGRATED SYSTEM*

| **Investment** | **Notional cost** |
|---|---|
| Provision of interconnections between CN and CP main track | $15 million to $20 million |
| Provision of new signal interlockings and consequent changes | $15 million to $25 million |
| Alteration of grade-crossing circuits (Lakeshore) | $10 million to $20 million |
| Improvements to CP main track | about $5 million |
| **Total** | **$45 million to $70 million** |

## 2.7 NOTIONAL TRACK OPERATING AND MAINTENANCE COSTS

An examination of VIA Rail's cost data indicates that approximately $15 million is paid annually to CN and CP (mostly CN) for use of the track between Toronto, Ottawa and Montreal as defined in the subject network. This figure is higher than that paid under the basis of estimated system-average variable unit cost, which was used in the past for determining compensation to the freight railways for passenger train use. It reflects an acceptance of the propositions that:

- the passenger service constitutes a substantial component of the traffic between Toronto and Montreal, and accounts for costs that would not be avoidable under most Canadian passenger-rail circumstances;
- for track for which VIA Rail is sole user, it must pay the total (not just the variable) cost;
- the costs of maintaining a track for higher than average speed passenger operations are higher than average; and
- incentive payments for service can be effective where regulatory compulsion fails.

CN's and CP's total cost,[9] not including corporate overhead, of maintaining and operating track in this network is about $75 million per year. (This amount includes the cost of train dispatching; the area includes the links to Ottawa.)

## 2.8 ATTRIBUTION OF COST

Shifting the proportions of freight and passenger to concentrate freight on the CP line would result in a larger proportion of the present CN track costs being attributed to the passenger system, especially that portion of the costs independent of traffic levels. Routine rail replacement and other maintenance requirements for the track specialized for passenger use can be expected to decrease simply because of the decreased traffic levels.[10] At the same time, higher passenger speeds would cause increased unit costs from:

- increased track damage due to dynamic loads; and
- tighter track (line, level and gauge) tolerances.

Presumably the track would be priced on the basis of the value of the service provided; traffic that could not cover its marginal cost would not be accepted. Estimates of service value and marginal cost are far beyond the scope of this very preliminary exploration; however, two cost allocation possibilities — essentially limits within which true causality should fall — are shown in Table 6(2)-2.

*Table 6(2)-2*
*ALLOCATION OF NOTIONAL TRACK OPERATING COSTS*

| | Proportion of traffic | | Allocated cost | |
|---|---|---|---|---|
| **Allocation** | **Tonne-km (%)** | **Train-km (%)** | **Tonne-km ($ million)** | **Train-km ($million)** |
| Passenger | 11 | 40 | 8 | 30 |
| Freight | 87 | 57 | 65 | 43 |
| Commuter | 2 | 3 | 2 | 2 |

Table 6(2)-2 does not include any charges for administration of a track operating authority or for necessary capital investment. Nor are GO Transit's track ownership or maintenance costs considered. It will be seen that annual operating costs allocated to passenger rail could well exceed current VIA Rail payments for track use by $5 million to $10 million. In addition, some portion of the roughly $60 million in one-time capital costs should be attributed to the passenger rail service. Track specialization, and the modest investment in track upgrading for passenger-only use, might improve the time of the faster Toronto to Montreal train from 4 h 10 min to about 3 h 30 min.

# ENDNOTES

1. This proposal considered joint CN and CP operations in the Fraser Canyon with westbound trains using CN tracks and eastbound trains using CP tracks. De Leuw Cather Canada Ltd., *Joint Track Usage Study: Kamloops–Mission B.C.*, November 1985.

2. An early reference to *running rights* appears in the *Railways Clauses Consolidation Act,* (8 Vict. c.20) of 1845 (British). Much Canadian railway legislation was patterned on this statute.

3. The running rights provisions in the *Railway Act* and the NTA, 1987 only apply to federally incorporated railways (this includes U.S. railroads connecting into Canada). The National Transportation Agency can order a federal railway to permit a connection with a provincially incorporated railway.

4. Recommendation by the National Transportation Agency and sanction by the Governor in Council are also required.

5. MOQ Rail is developing a prototype operation using highway type trailers fitted with both highway type wheels and steel rail type wheels. The motive power would be provided by highway style cabs. The trailer concept has similarities to the successful RoadRailer system operated by Triple Crown (a subsidiary of Norfolk Southern) in the United States. The motive power is a new departure.

6. Such a scheme for trains to and from western Canada has been discussed for many years and may have benefits for CN and CP independently of any passenger system benefit.

7. For example, four passenger trains stop at Kingston during a half-hour period on weekday mornings. Often, one or more of these trains must wait for one of the other passenger trains to clear the station.

8. For example, at Brockville, additional delay is sometimes incurred because there is direct foot access to only one track, and there is no physical barrier between the two main tracks. Providing a passenger underpass or overpass, and building a fence between the tracks would eliminate some of the problems here.

9. Operating cost and sustaining capital.

10. The counterpart to much of this savings would be increased replacement and maintenance requirements for the CP track to which the freight traffic would be shifted.

# ANNEX 1

## THE *NATIONAL TRANSPORTATION ACT, 1987*

Provisions of the *National Transportation Act, 1987* (NTA, 1987) dealing with running rights and joint track usage are under the title Railway Freight.

- Section 148 authorizes the National Transportation Agency to direct one railway company to provide access to another and to set the required amount of compensation the user must pay. The Agency may exercise this power where the two companies cannot reach an agreement and rail access is deemed to be in the public interest.
- Section 149 authorizes the Governor in Council, after specified process, to order common use of a railway right-of-way and fix the amount of compensation to be paid for that common use.

Presumably such provisions apply solely to freight. There is no obvious reason why they should not also be made applicable to passenger rail.

Subsection 174(6) provides that when a railway line is transferred from one railway company to another, the selling railway is relieved of its obligations related to the operation of that line under the NTA, 1987 or any other Act of Parliament. However, when VIA Rail has an existing operation on a line sold by a federal company to another company (either federal or provincial), the line remains under federal jurisdiction. The acquiring company inherits all the obligations of the selling company, including those under the *Canada Labour Code,* for example, the selling railway's collective agreements.

If a line with VIA Rail service transferred from one company to another is then abandoned, or VIA Rail service is discontinued, the line is no longer deemed to be a work for the general advantage of Canada and may be transferred out of federal jurisdiction.

# NOTES TO CHAPTER 7:
# ENVIRONMENTAL EFFECTS OF INTERCITY PASSENGER TRANSPORTATION

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# 1. INTRODUCTION

The Royal Commission's considerations of environmental issues were aided by two pieces of contracted research. The first is by VHB Research & Consulting Inc., "Environmental Damage from Transportation," published in Volume 4 of this report,[1] which summarizes the nature and effects of environmental damage, and provides estimates of air pollutant emissions by intercity passenger mode in Canada. It also considers the practicality of methods of assessing the social costs of environmental damage, and offers some estimates of the costs of air pollution per mode. In view of its availability in Volume 4, only the briefest summary of the effects will be provided in these notes.

The second piece is by William A. Sims, "Externality Pricing," which is distributed as RR-07 in the series of reports prepared for the Royal Commission.[2] It reviews the theoretical case for direct pricing of such externalities as environmental damage, from the economic literature. The policy issues in charging for environmental damage, or otherwise approaching damage mitigation through economic incentives/ disincentives, are also reviewed thoroughly in a Government of Canada paper that became available during the Commission's deliberations, *Economic Instruments for Environmental Protection.*[3]

## 1.1 MAIN ENVIRONMENTAL EFFECTS

The environmental effects of passenger transportation that are of main policy concern are:

- air pollution;
- global warming; and
- noise.

Another important environmental effect is the disruption of local communities by transport infrastructure and traffic.

These effects all cause harm to natural ecosystems or to people or communities, but harm that is outside our normal system of markets. Thus, it is unpriced, failing to appear as a cost to the transport carrier or passenger. These effects also all differ spatially, seasonally and by time of day. A pricing system that incorporated these "externalities" in decisions about infrastructure investment and use would (at least to some extent) reduce the extent of transportation, and cause shifts toward those modes of travel, locations and times that would cause less environmental damage.

Most of what follows in these notes refers to air pollution and global warming because those are the effects for which most information is available. It is anticipated that a policy framework dealing with these effects should also apply to noise and community disruption; some relevant policy aspects of the damage are mentioned below.

## 2. EMISSIONS FROM ENGINES AND VEHICLES

### 2.1 EMISSIONS OF MAIN CONCERN[4]

#### 2.1.1 Volatile Organic Compounds

Volatile organic compounds (VOCs) include the volatile hydrocarbons of unburned fuel in exhaust gases, or evaporated from engines and gas tanks (and filling stations). These are of concern primarily because of their contribution to the formation of low-level ozone (discussed later). About 40% of all VOCs from non-natural (man-made) sources originates from transportation.

#### 2.1.2 Nitrogen Oxides

Oxides of nitrogen ($NO_x$) are fuel combustion by-products, formed particularly at high engine temperatures, and, therefore, disproportionately by diesel engines. Nitrogen dioxide ($NO_2$) is of concern because it can cause harm to health and damage to vegetation, and it reduces urban visibility (forming the brown haze on hot days in large cities). Through chemical conversion, $NO_x$ also contributes to the formation of ozone and of nitric acid, a component of acid rain. Transportation is responsible for about 60% of all non-natural $NO_x$ emissions.

The most important, and complex, role of transportation $NO_x$ is in the formation of ozone. This gas is important to the environment in two very different ways. More familiar to the public is the "ozone layer" in the high atmosphere, which acts as a reflective screen against solar ultraviolet radiation, preventing harmful amounts of radiation from reaching the Earth's surface, where they would add to global warming and increase skin cancer. The concern is that this layer is being depleted through artificial disruption of natural processes.

Quite the opposite concern is expressed when ozone exists in the atmosphere close to ground level, where its effects are harmful rather than beneficial. Low-level ozone is formed from chemical conversion of $NO_x$ in sunlight, with VOCs aiding the reactions. Non-natural emissions are partially responsible, including those from transportation. This "low-level" ozone can be transported downwind, but breaks down through further chemical processes within hours or days. Concentrations increase over cities with high $NO_x$ and VOCs emissions, particularly in summer, in "episodes" that last a few days. Effects can be felt over regions encompassing groups of cities arranged along the direction of the prevailing air currents, and over the intervening rural areas.

Ozone concentrations are greatest in three regions of Canada: the Lower Fraser Valley of British Columbia; the "corridor" between Windsor, Ontario, and Quebec City, Quebec; and in the area of Saint John, New Brunswick. Ozone originating from adjacent U.S. industrial areas is largely responsible for the concentrations in the latter region, and contributes substantially to concentrations in southern Ontario and Quebec.

Potential harmful effects of low-level ozone include respiratory problems and damage to foliage of crops and trees. Furthermore, ozone in the lower atmosphere itself acts as a "greenhouse gas," absorbing heat radiated from the Earth and adding to global warming.

The low-level ozone is effectively unconnected to the high-level "ozone layer," so the Earth faces simultaneously an excess of ozone in the lower atmosphere and depletion in the upper atmosphere.

The contribution of transportation $NO_x$ to ozone formation, as well as its effects, depends on the altitude at which the emissions occur. As the great bulk are at ground level (from motor vehicles, trains and ships), the main potential problem is the direct damage ozone causes to people and foliage.

Aircraft emissions, however, present different problems. There is increasing evidence that $NO_x$ emitted by aircraft in the high troposphere (at the cruising altitude of modern jets) is particularly potent at producing ozone.[5] That ozone is unlikely to reach people and crops at ground level, but might be adding substantially to global warming. Furthermore, supersonic aircraft operate at much higher altitudes, close to, or even within, the "ozone layer." Paradoxically, their emissions of $NO_x$ at those altitudes do not create ozone, but actually contribute to its depletion. At present, there are very few such aircraft operations, but if the supersonic fleet were to expand greatly, control of their $NO_x$ emissions might become a priority.

### 2.1.3 Carbon Monoxide

Carbon monoxide (CO) is a combustion by-product with potentially serious health effects. About 60% of total non-natural emissions are from transportation, and 75% of transportation emissions come from passenger cars, pick-up trucks and vans.

### 2.1.4 Particulates

Particulates are solid materials in engine exhaust, consisting of about 75% carbon (soot) and 25% "polycyclic aromatic hydrocarbons," which potentially cause cancer. Transportation sources account for only about 1.3% of total non-natural particulate emissions, but a larger portion of the very small particles that are considered more problematic (those less than one hundredth of a millimetre in diameter). Very small particles are emitted more by diesel engines than by gasoline engines or turbines.

### 2.1.5 Sulphur Dioxide

Sulphur dioxide ($SO_2$) is a by-product of burning fossil fuels containing sulphur. It is of concern for its potential direct health effects and also its conversion to form sulphuric acid, the predominant acid in acid rain. Emissions depend on the amount of sulphur in fuels (including how much is removed from oil during refining). The sulphur content of diesel is higher than that of gasoline and aviation fuel, and is greater for marine diesel than for diesel used in motor vehicles or trains. Transportation contributes only about 2.2% of total non-natural emissions in Canada, of which one third is from marine engines. Non-ferrous smelting and thermal power generation provide the bulk of emissions.

### 2.1.6 Chlorofluorocarbons

Chlorofluorocarbons (CFCs) are used as blowing agents, coolants in air conditioning systems and refrigeration in all transport modes, and in foam padding and seats. CFCs are of concern for their destruction of the ozone layer. Motor-vehicle air conditioners have recently contributed about 25% of Canadian CFC emissions; the remainder comes largely from commercial refrigeration and air conditioning. Replacement chemicals are expected to be introduced rapidly in accordance with Canada's announced goal to eliminate CFC use by 1997. (This goal is discussed later in this chapter.)

### 2.1.7 Carbon Dioxide

Carbon dioxide ($CO_2$) is a by-product of combustion of any carbon-based fuel (such as oil, coal or wood), and is of concern as the major contributor to the "greenhouse effect" of global warming. Unlike VOCs, $NO_x$ and CO, which can be controlled by exhaust-treatment techniques, $CO_2$ remains unchanged, and therefore varies directly with the amount of fuel used. About one quarter of total non-natural emissions are from transportation, the bulk of the remainder being from power generation, industrial energy use and space heating. $CO_2$ is released naturally by all plants and animals as a consequence of energy production (as when the body processes food carbohydrates and oxygen into energy, creating waste products of carbon dioxide and water vapour); $CO_2$ is also the result of natural decaying or burning of vegetation, and of volcanic activity.

## 2.2 AMOUNTS OF EMISSIONS BY INTERCITY MODES

Emissions by mode, in grams per unit of fuel used, were obtained from the VHB study for the Royal Commission, reproduced in Volume 4 of this report.[6] Estimates are provided of energy use by mode in megajoules per passenger-kilometre, and of emissions in grams per passenger-kilometre of $CO_2$, $SO_2$, $NO_x$, non-methane hydrocarbons (VOCs), particulates and CO. For intercity passenger travel, and the attempts to cost and price the environmental damage, it is assumed that the crucial emissions are those of $CO_2$, $NO_x$ and VOCs, so the estimates that follow are confined to those.

The estimates of emissions for passenger cars were modified to combine estimates for cars and light trucks, based on light truck emissions of $NO_x$ and VOCs being 20% greater per vehicle-kilometre than car emissions. (This value was derived from weighted national averages of the information in Tables 5 and 6 of the VHB report.) Highway fuel consumption, and therefore $CO_2$ emissions, are estimated to be 33% higher per vehicle-kilometre for light trucks (12 L/100 km versus 9 L/100 km). The combined results appear as estimates for "cars" in the tables.

The estimates of average fuel consumption by mode were also modified by the Royal Commission staff, as discussed in the Notes to Chapter 3. The VHB estimates of emissions by mode have been converted first to grams per megajoule (g/MJ) of fuel, represented in Table 7(2)-1.

*Table 7(2)-1*
*Ratios of Emissions to Energy Use (g/MJ)*

| Mode | $CO_2$ | $NO_x$ | VOCs |
|---|---|---|---|
| Bus | 70.8 | 0.915 to 0.962 | 0.106 to 0.135 |
| Car | 73.8 | 0.388 to 0.482 | 0.488 to 0.599 |
| Train | 70.7 | 1.428 to 1.442 | 0.069 to 0.195 |
| Airplane | 70.8 | 0.045 to 0.174 | 0.030 to 0.037 |
| Ferry | 81.6 | 0.091 to 0.120 | 0.009 to 0.012 |

These are multiplied by estimated system-wide average consumption of MJ of energy, obtained from Royal Commission staff estimates of average fuel use, as in Table 7(2)-2.

*Table 7(2)-2*
*System-Wide Average Fuel Use by Mode*

| Mode | Energy/Fuel (MJ/L) | Amount travelled/ Fuel (pass-km/L) | Energy/Amount travelled (MJ/pass-km) |
|---|---|---|---|
| Bus | 38.68 | 57.8 | 0.67 |
| Car | 34.66 | 18.6 | 1.86 |
| Train | 38.68 | 23.4 | 1.65 |
| Plane | 37.68 | 9.7 | 3.88 |
| Ferry[a] | 38.68 | 5.2 | 7.39 |

**a. See endnote 7.**

Then multiplying g/MJ by MJ/pass-km gives grams of emissions per passenger-kilometre by mode, as in Table 7(2)-3.

*Table 7(2)-3*
*Estimated Emissions per Passenger-Kilometre (g/pass-km)*

| Mode | $CO_2$ | $NO_x$ | VOCs |
|---|---|---|---|
| Bus | 51.7 | 0.500 to 0.860 | 0.070 to 0.100 |
| Car | 125.5 | 0.659 to 0.819 | 0.829 to 1.019 |
| Train | 116.9 | 2.361 to 2.385 | 0.115 to 0.323 |
| Plane | 274.9 | 0.175 to 0.676 | 0.116 to 1.144 |
| Ferry | 603.0 | 0.672 to 0.887 | 0.067 to 0.089 |

## 2.3 SUMMARY OF KNOWLEDGE OF EFFECTS[8]

### 2.3.1 Health

The federal government has established National Ambient Air Quality Objectives (NAAQOs)[9] for the major pollutants, specifying levels that are the maximum "acceptable," intended to provide adequate well-being and personal comfort. Measurements of pollutants are taken continually by Environment Canada at numerous sites across the country. Interpretation of the results shows that, while there are some potential health problems posed by high local concentrations of CO, $NO_2$ and diesel particulates, none of these is found routinely in concentrations that violate the National Ambient Air Quality Objectives.[10]

A much greater concern is the exposure of people to low-level ozone. Canada's NAAQOs for a one-hour exposure to ozone is exceeded occasionally in most large cities, and regularly so in the Lower Fraser Valley of British Columbia, southern Ontario, the area of Quebec between Montreal and Quebec City, and southeastern New Brunswick.[11] There is evidence that ozone at these concentrations causes breathing difficulties, particularly among asthmatics (5% of the population). Periods of high ozone have also been linked with increases in hospital admissions and use of medication for respiratory problems.[12]

### 2.3.2 Materials

Acid rain can affect building stone and mortar; $NO_2$, nitric acid and ozone can affect paints; $NO_2$ and ozone can affect fabrics; $SO_2$, $NO_2$ and nitric acid can affect metals. But the laboratory demonstrations of these effects are conducted using concentrations far higher than exist in Canada. The VHB research report for the Royal Commission concludes there is "no evidence that existing levels in the Canadian environment adversely affect materials."[13]

### 2.3.3 Forest Resources

Substantial effects of acid rain on germination and survival of tree seedlings are seen only at levels of acidity higher than found in Canadian rainfall, and no definitive trends in responses of forests to ozone have been found.

### 2.3.4 Crops

Effects of ozone in damaging foliage, and therefore crop yields, are well established, with resulting reductions in annual crop values estimated for Ontario at $15 million to $23 million in 1984.[14] $NO_2$ and acid precipitation at Canadian levels are not thought to cause substantial damage to crops.

### 2.3.5 Fish

$NO_x$ deposited as acid rain has adverse effects on life in eastern Canadian lakes. Approximately 150,000 lakes are being damaged, more than 14,000 of which have been described by Environment Canada as "acidified."[15]

## 2.4 GLOBAL WARMING

Scientific concern has increased that non-natural additions of certain gases to the atmosphere increase the atmosphere's retention of radiated heat in a "greenhouse effect" that raises average global surface temperatures. Research has not produced definitive findings on the extent and effects of such warming, so an Intergovernmental Panel on Climate Change was established in 1988, under the United Nations Environment Programme. This panel of scientists reviewed the scientific evidence, concluding:

> We are certain of the following:
>
> - There is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be.
> - Emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse

> gases: carbon dioxide, methane, chlorofluorocarbons and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface.[16]

The panel predicts that, if no control measures are taken, global mean temperature will rise above pre-industrial levels by more than 2°C by 2050 and 4°C before 2100. Among the important effects, thermal expansion of the oceans and melting ice would raise global mean sea level by about 6 cm per decade.

The Canadian Climate Program Board has predicted that the potential effects in Canada would include:

- a shift of climatic zones several hundred kilometres northward over the next 50 years, significant degradation of permafrost, changes to ecosystems and wildlife habitat at so fast a rate that some species may be unable to survive, disruption to northern indigenous people, and threats to northern buildings and pipelines;
- increased drought risks, especially in the Prairies;
- increased probabilities of forest fire and insect and disease attacks;
- adverse effects on human health from more frequent and intense heat waves in cities, and the northward spread of tropical diseases; and
- an increase in soil erosion, changes to coastal ecology, damage to wetlands and important fisheries, and substantial costs for coastal protection due to rising sea levels.

The Board also suggests there is some potential for northward expansion of agricultural crops where soils permit.[17]

Descriptions of potential global effects are provided in a recent U.S. National Academy of Sciences study.[18] To date, estimates of the costs that would be imposed by the predicted effects have not been made for Canada, and are rare worldwide. Predictions of the effects by sector of activity in the United States lead Nordhaus[19] to suggest that identifiable costs would be equivalent to about one quarter of 1% of national income, and his judgement is that including unmeasured effects and uncertainty puts the upper limit at 2% of national income.

## 3. CURRENT AND ANNOUNCED CONTROL STRATEGY FOR AIR POLLUTION

### 3.1 VEHICLE EMISSION STANDARDS

Control of transportation air pollutants is mostly by federal regulation of limits for emissions from new vehicles, and is essentially limited to road vehicles. Aircraft jet engines are subject to limits set by the International Civil Aviation Organization, to which all Canadian engines conform, even though the standards have no legal force in Canada. No regulations exist for locomotive engines. Ships are subject only to a federal smoke limit, which is a remnant of the coal-fired steamship era.

Motor-vehicle exhaust emissions are controlled by regulations for new vehicle performance under the federal *Motor Vehicle Safety Act*, administered by Transport Canada. The standards were tightened substantially for new cars in 1986 and new trucks in 1988, essentially to be equal to U.S. standards. Those standards in the United States have since been made even more stringent, and plans have been announced by Environment Canada and Transport Canada to "harmonize" with those shortly.[20] Thereafter it is the intention to maintain equivalence with the United States, thus continuing to have the most stringent standards in the world. Those plans also include examining the feasibility of regulating emissions released by aircraft, ships and trains.

Emissions through the lifetimes of motor vehicles are regulated to some extent through the new vehicle standards, which specify performance to be met over a designated vehicle lifetime. Nevertheless, emissions can increase over lifetime through poor maintenance or tampering with emission control equipment. Provincial programs of compulsory periodic emissions testing are proposed in the $NO_x$/VOCs Management Plan for the "ozone non-attainment areas" of southern British Columbia and the Windsor to Quebec City corridor (see description of the Plan, which follows). British Columbia introduced a testing program for cars and light trucks in the lower mainland in September 1992.

## 3.2 ANNOUNCED NATIONAL OZONE CONTROL STRATEGY

### 3.2.1 Multinational Goals

*$NO_x$:* Under the $NO_x$ Protocol of 1988, Canada and 24 other countries are committed to freezing national $NO_x$ emissions at 1987 levels. Canada's strategy is contained in the $NO_x$/VOCs Management Plan.

*VOCs:* By a similar international agreement signed in November 1991, Canada will by 1999 freeze VOCs at 1988 levels, and reduce them by 30% in two areas designated under the agreement as "tropospheric ozone management areas": the Lower Fraser Valley and the Windsor to Quebec City corridor.

### 3.2.2 $NO_x$/VOCs Management Plan

Recognizing ozone as the prime air pollution problem in Canada, the Canadian Council of Ministers of the Environment (CCME) adopted, in November 1990, a Management Plan for $NO_x$/VOCs.[21] The Plan includes a number of new nation-wide regulations, which in the transport sector involve further tightening of motor-vehicle emission standards starting in 1996. In addition, the Plan designates the three Canadian regions that frequently exceed ozone NAAQOs as "ozone non-attainment areas": the Lower Fraser Valley, the Windsor to Quebec City corridor, and the Saint John area. For these, separate targets for $NO_x$ and VOCs reductions are being negotiated with the provinces concerned, and the plan envisages adopting special local control measures. The list being considered initially includes, for the transport sector:

- more rigorous speed-limit enforcement in summer;
- motor-vehicle inspections and anti-tampering laws;
- reduction in summer gasoline volatility; and
- evaporative loss controls at refuelling stations.

The plan includes forecasts to 2005 of expected changes in emissions, based on economic and population growth estimates, National Energy Board (NEB) estimates of energy demand by sector of activity, and demand growth estimates and input fuel mixes for electricity generation provided by provincial power utilities. For road transportation, it includes forecasts of vehicle sales provided by the Motor Vehicle Manufacturers Association, together with NEB estimates of total vehicle fleet size and use (assuming constant annual kilometres per vehicle).[22]

Effects of the Plan were predicted as changes in these forecasts. Some details of the main sources of $NO_x$ and VOCs are shown in Tables 7(2)-4 and 7(2)-5, together with predictions for 2005 with and without the impacts of the new Plan. It can be seen that emissions of both $NO_x$ and VOCs were predicted to increase by about 6% from 1985 to 2005 in the absence of the Plan, as growth in the use of stationary sources outweighed the very substantial continuing reductions in transport sources resulting from already-established motor-vehicle standards. The Plan expects $NO_x$ levels to decrease until 1995 due to a sharp decline in emissions from light and heavy vehicles. This will result from increasing numbers of vehicles equipped with emission controls that meet recent standards, combined with modest reductions in rail emissions. These transportation reductions outweigh increases in emissions from other sectors until about 1995. Thereafter, the increases in motor-vehicle use are expected to offset remaining reductions in average fleet emissions per vehicle-kilometre, so that total national emissions first flatten and then begin to rise slowly as emissions continue to grow in other sectors.

## Table 7(2)-4

## NITROGEN OXIDES EMISSIONS AND PROJECTIONS TO 2005

| Source | 1985 (kt) | Proportion of total (%) | 2005 base case (kt) | Change from 1985 (%) | 2005 with plan[a] (kt) | Change from 1985 (%) |
|---|---|---|---|---|---|---|
| **Transport** | | | | | | |
| Road | | | | | | |
| Cars, light trucks | 453 | 24.0 | 238 | −47 | 169 | −63 |
| Heavy trucks | 285 | 15.1 | 260 | −9 | 235 | −18 |
| Off-road | 261 | 13.8 | 346 | +33 | 338 | +30 |
| Subtotal road | 999 | 52.9 | 845 | −15 | 742 | −26 |
| Air | 33 | 1.8 | 42 | +27 | 42 | +27 |
| Water | 15 | 0.8 | 19 | +24 | 19 | +24 |
| Rail | 132 | 7.0 | 113 | −15 | 113 | −15 |
| **All transport** | **1,180** | **62.5** | **1,018** | **−14** | **916** | **−22** |
| **Stationary sources** | | | | | | |
| Power generation | 248 | 13.1 | 352 | +42 | 230 | −7 |
| Natural gas industry | 159 | 8.4 | 205 | +29 | 202 | +27 |
| Indust./comm. fuel use | 145 | 7.7 | 207 | +43 | 141 | −3 |
| Residential fuel use | 41 | 2.2 | 37 | −11 | 33 | −20 |
| Industrial processes | 89 | 4.7 | 140 | +57 | 129 | +45 |
| Other | 25 | 1.3 | 36 | +44 | 37 | +48 |
| **All stationary sources** | **707** | **37.5** | **977** | **+38** | **772** | **+9** |
| **TOTAL** | **1,887** | **100.0** | **1,995** | **+6** | **1,687** | **−11** |

**Source: Canadian Council of Ministers of the Environment, *Management Plan for Nitrogen Oxides and Volatile Organic Compounds, Phase I*, November 1990.**

**a. After implementation of the measures currently outlined in the $NO_x$/VOCs Management Plan.**

### Table 7(2)-5

### Volatile Organic Compounds Emissions, and Projections to 2005

| Source | 1985 (kt) | Proportion of total (%) | 2005 base case (kt) | Change from 1985 (%) | 2005 with plan[a] (kt) | Change from 1985 (%) |
|---|---|---|---|---|---|---|
| **Transport** | | | | | | |
| Road | | | | | | |
| Cars, light trucks | 557 | 31.2 | 350 | –37 | 262 | –53 |
| Heavy trucks | 54 | 3.0 | 48 | –11 | 48 | –11 |
| Off-road | 90 | 5.0 | 109 | +22 | 109 | +22 |
| Subtotal road | 700 | 39.3 | 507 | –28 | 419 | –40 |
| Air | 10 | 0.6 | 13 | +30 | 13 | +30 |
| Water | 28 | 1.6 | 32 | +13 | 32 | +13 |
| Rail | 7 | 0.4 | 6 | –15 | 6 | –15 |
| **All transport** | **745** | **41.8** | **558** | **–25** | **469** | **–37** |
| **Stationary sources** | | | | | | |
| Solvent use | 502 | 28.2 | 603 | +20 | 431 | –14 |
| Industrial processes | 152 | 8.5 | 239 | +57 | 173 | +14 |
| Fuelwood combustion | 108 | 6.0 | 133 | +23 | 133 | +23 |
| Slash burning | 80 | 4.5 | 129 | +60 | 129 | +60 |
| Gas distribution | 109 | 6.1 | 124 | +14 | 67 | –39 |
| Industrial fuel use | 50 | 2.8 | 64 | +29 | 60 | +21 |
| Other | 36 | 2.0 | 42 | +17 | 42 | +17 |
| **All stationary sources** | **1,037** | **58.2** | **1,334** | **+29** | **1,034** | **(no change)** |
| **TOTAL** | **1,782** | **100** | **1,892** | **+6** | **1,504** | **–16** |

**Source: Canadian Council of Ministers of the Environment, *Management Plan for Nitrogen Oxides and Volatile Organic Compounds, Phase I*, November 1990.**

**[a] After implementation of the measures currently outlined in the $NO_x$/VOCs Management Plan.**

For VOCs, a rapid decline in emissions is also expected from motor vehicles in the short term, outweighing increases in other sectors. Motor vehicles, however, contribute a smaller proportion of total VOCs emissions than total $NO_x$ emissions, and their reductions are expected to be overtaken earlier than 1995 by persistent increases in VOCs from non-transportation sources.

Adopting proposals identified in the national Plan would reduce total $NO_x$ emissions in 2005 by about 11%, and VOCs emissions by 16% over recent levels. The Plan also envisages tightened objectives and extended programs in the future, particularly in the non-attainment areas.

The CCME forecasts that implementing the Plan will substantially reduce peak ozone concentrations and periods exceeding the maximum acceptable NAAQO. In 2005, the annual hours in excess of the latter standard would be halved in the Lower Fraser Valley and Saint John area, and reduced by 20% to 40% in the Windsor to Quebec City corridor, east of Toronto.[23] The improvements are expected to be even greater when combined with announced control programs in the United States. The CCME expects implementation of the amendments to the U.S. *Clean Air Act* to reduce $NO_x$ emissions by 30% and VOCs emissions by 40% to 50% in those regions of importance to Canadian ozone concentrations (the U.S. Eastern Seaboard, the area south and west of lakes Erie and Ontario, and the Seattle area). This reduction will bring important additional reductions in periods exceeding the maximum acceptable NAAQO for ozone in southwest Nova Scotia and throughout the Windsor to Quebec City corridor, particularly to the west of Toronto.[24]

## 4. GLOBAL WARMING AND CANADA'S PROPOSED ACTIONS[25]

### 4.1 GREENHOUSE GAS EMISSIONS IN CANADA

Minor transport contributions to global warming arise from CFCs in automobile air conditioners and methane from natural gas distribution. Low-level ozone, to which transport emissions of $NO_x$ and VOCs contribute, also adds to the greenhouse effect. All such contributions are dwarfed by transport emissions of $CO_2$ from burning carbon fuels.

#### 4.1.1 Carbon Dioxide

Emissions of $CO_2$ in 1990, and projections for the years 2000 and 2010, are shown in Table 7(2)-6. It will be seen that transport accounts for about 25% of the Canadian total of some 520 Mt, with road vehicles alone responsible for about four fifths of the transport contribution, or 20% of the total.

*Table 7(2)-6*
CARBON DIOXIDE EMISSION PROJECTIONS 1990–2010[a]

| Source | 1990 (Mt) | Proportion of total (%) | 2000 (Mt) | Change from 1990 (%) | 2010 (Mt) | Change from 1990 (%) |
|---|---|---|---|---|---|---|
| **Transport** | | | | | | |
| Road | | | | | | |
| Cars, light trucks | 67 | 12.9 | 70 | +4 | | |
| Heavy trucks | 41 | 7.9 | 46 | +12 | | |
| Subtotal road | 108 | 20.8 | 116 | +7 | | |
| Air | 14 | 2.9 | 16 | +18 | | |
| Water | 5 | 1.0 | 6 | +10 | | |
| Rail | 3 | 0.6 | 4 | +15 | | |
| **All transport** | **132** | **25.5** | **141** | **+7** | **150[b]** | **+15** |
| **Stationary sources** | | | | | | |
| Residential | 57 | 11.0 | 57 | (no change) | 57 | (no change) |
| Commercial | 27 | 5.2 | 30 | +11 | 32 | +20 |
| Industrial | 133 | 25.7 | 159 | +20 | 200 | +50 |
| Producer consumption | 77 | 14.9 | 93 | +20 | 107 | +40 |
| Power generation | 92 | 17.8 | 108 | +17 | 130 | +40 |
| **Total** | **518** | **100** | **590** | **+14** | **675** | **+30** |

**Source: National Energy Board, and Transport Canada; distributions within transport sector interpolated from Transport Canada estimates for 1987 and 2005.**

**a. One tonne of carbon dioxide contains 0.2727 tonnes of carbon.**
**b. Modal breakdown not available for 2010.**

The projections are made by the National Energy Board (NEB),[26] using historical relationships among $CO_2$, national output, population growth and energy prices. Central assumptions are that gross domestic product (GDP) will grow at 2.3% per annum, the number of households at about 1.4% per annum, and the car stock at about 1.5% per annum, while the price of crude oil increases from US$20/barrel in 1990 to US$27/barrel in 2010 (in constant 1990 dollars). Growth in energy use overall and in $CO_2$ are expected to be at lower rates over the next 20 years than during the last two decades, which will continue the substantial downward trend in emissions per unit of GDP.

The table shows that NEB's base-case forecast for 2000 is for total $CO_2$ to increase by 14% from 1990, to about 590 Mt. The overall growth predicted for transport sources to 2000 is about the same as for all other sources, but within transport the contributions of heavy trucks and aircraft increase faster than those of the other vehicle types.

By 2010, the base-case forecast is for emissions to increase by about 30% over 1990 levels to 675 Mt. The greatest increases are in industrial uses (50% over 1990 levels) and power generation and producer consumption (40%). Growth is expected to be only about 15% in the transport sector, and negligible in residential energy use.

## 4.2 CANADA'S GOALS ON GLOBAL WARMING

### 4.2.1 CFCs

With the protocol signed in 1987 in Montreal, Canada committed to a 50% reduction of CFCs by 2000. At the London Conference of June 1990, all original signatories agreed to increase the target to 100% phase-out by 2000, while Canada and 12 other countries declared they would eliminate CFCs by 1997. The prime motivation for CFC control is protection of the stratospheric ozone layer, but CFCs are also the most potent of the greenhouse gases per unit of weight.

### 4.2.2 $CO_2$

At the May 1990, UN Conference in Bergen, Norway, Canada committed to stabilize greenhouse gas emissions, other than CFCs, at 1990 levels by 2000. The CCME describes this as "a national target which does not pertain to specific regions or sectors." Canada is also committed to the UN Framework Convention on Climate Change, completed in May 1992, and signed by the Prime Minister at the UN Conference on Environment and Development in Rio de Janeiro in

June 1992.[27] That convention is less specific in its goals. Its objective reads in part (Article 2):

> The ultimate objective . . . is to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Its "commitments" in Article 4 include:

> Each of [the developed country] Parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions and other greenhouse gases . . . would contribute to such modification. . . .

and:

> In order to promote progress to this end, each of these Parties shall communicate, within six months of entry into force of the Convention for it and periodically thereafter, . . . detailed information on its policies and measures . . . as well as on its resulting projected anthropogenic emissions . . . with the aim or returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases. . . .

As illustrated by Table 7(2)-6, the goal of stabilization by 2000 at 1990 levels would require reductions in national $CO_2$ emissions by 14% from the NEB base-case forecast — in addition to the improvements in motor-vehicle fuel consumption and residential conservation already included in that forecast.

## 4.3 $CO_2$ REDUCTION MEASURES: TRANSPORTATION FUEL CONSERVATION

Federal fuel consumption policy has been limited to road vehicles, specifically cars, pick-up trucks and vans. In 1976, the government agreed with motor-vehicle manufacturers that the U.S. standards for fuel consumption of new vehicles would be met in Canada on a voluntary basis. These standards involve average fuel consumption targets being met separately for cars and "light trucks," averaged across each manufacturer's sales. With the agreements being renewed periodically, this has meant that Canada has essentially achieved fuel consumption improvements matching those under the U.S. mandatory standards. (In fact, Canadian fuel consumption has been slightly better in recent years, as Canadians have, on average, bought slightly lighter and smaller-engined vehicles than Americans.)

Extensive action has been taken by provincial and municipal governments to achieve greater fuel efficiency in transport. The 1970s and 1980s saw the introduction of a great variety of measures to encourage the use of public transport and discourage the use of private cars, including expansions of public transit networks and greater subsidization of their use; "park-and-ride" facilities; incentives for car-pooling; and traffic control and parking restrictions to limit use of private cars. In addition, incentives have been offered for using propane or compressed natural gas (conversion grants and lower excise taxes on the fuels), and many provinces and municipalities have converted some of their own vehicles to use these alternative fuels.

The federal government expects that substantial improvements in new motor-vehicle fuel consumption will continue to be made by manufacturers in the coming decades. *Canada's Green Plan*[28] includes reconsideration of mandatory federal standards. A radical tightening of U.S. fuel efficiency standards is also under consideration (to an average of 40 miles per U.S. gallon for cars). In Canadian terms, this equates to 5.9 L/100 km — compared with the current voluntary standard for new vehicles of 8.6 L/100 km, and the average consumption of cars in use of about 12 L/100 km. Such improvements are feasible through a combination of increased engine efficiency and reduction in vehicle weight.[29]

It can also be anticipated that development of alternative fuels for motor vehicles will help to limit the use of gasoline and diesel fuel. Of the alternatives available in the immediate future, compressed natural gas offers the potential of up to a 20% reduction in $CO_2$ per unit of distance (over the whole cycle of production and use), while methanol offers less than 5% if produced from natural gas, and up to 100% if produced from biomass.[30] Some experts suggest that, in the long term, a transport system fuelled by electricity (produced without carbon fuels, by using hydro-electric, nuclear or solar energy) or fuelled by hydrogen will develop.[31] Such fuels would emit almost none of the pollutants and greenhouse gases. However, the prospects of this system developing on a large scale within the next 30 years or so remain very remote,[32] and the carbon-fuelled internal combustion engine will likely survive with little change for at least that period. In the interim, air pollutant and $CO_2$ emissions should be reduced substantially as vehicle fuel consumption improves, and it is likely also that greater use will be made of such alternative fuels as methanol, propane and natural gas, offering further reductions.

## 4.4 POTENTIAL $CO_2$ REDUCTION MEASURES

CCME has announced some initial steps toward setting sectoral goals, but has not yet agreed on programs. Its *National Action Strategy on Global Warming* suggests specific measures that might be pursued, including:

- replacing the use of fossil fuel in generating electricity by using nuclear, hydro-electric, wind, solar or tidal power;

- obtaining more efficient generation from fossil fuels, for example, by using "clean coal" technology or cogeneration;
- investing in conservation rather than generating capacity;
- applying "marginal cost and peak-load pricing" of electricity;
- increasing the use of mass transit, through restricting car access to city cores, raising parking fees, or charging urban highway tolls;
- improving traffic flows and reducing traffic densities through urban signal coordination, and so on; and
- promoting staggered working hours and working at home.[33]

The U.S. National Academy of Sciences study also includes an assessment of potential mitigation technologies.[34] Its conclusion is that decisions should be guided by the overall cost-effectiveness of the options, and it recommends that a substantial list of currently available technologies be adopted. The study concludes that this action could reduce U.S. greenhouse gas emissions by 10% to 40%, at relatively low costs or even at net savings.[35] It further states that options requiring great expense are not justified. It recommends moving toward "full-cost pricing" of energy.

## 5. POTENTIAL ROLE OF ECONOMIC INSTRUMENTS

Recent discussions of strategies for environmental protection, in Canada and elsewhere, give great prominence to the potential of applying pricing or using other market mechanisms (referred to more generally as "economic instruments") instead of, or in support of, regulations.[36] As well as specific pricing proposals, the CCME Strategy on $CO_2$ emphasizes the potential role for more general economic instruments such as carbon taxes or a carbon emissions trading system.[37] The *Green Plan* frequently mentions the potential for economic instruments, and recommends their development.[38]

Also, under the $NO_x$/VOC Management Plan, consideration is being given to introducing emissions trading programs within one non-attainment area, the Lower Fraser Valley.[39]

The main economic instruments of relevance are emissions charges and tradeable emissions permits.

## 5.1 EMISSIONS CHARGES[40]

### 5.1.1 Description

The most elegant form of emissions charging system would add the social costs imposed by the emissions to the price of any activity that produced them.[41] Those activities would then only be undertaken if participants obtained benefits that outweighed the social costs, and participants would also invest in controls that were cheaper than the alternative charges. Economists predict that, unless the type of environmental damage is so severe that it must be entirely eradicated, charging for its costs would be more efficient than regulating its reduction because charging would automatically lead to the least-cost pattern of abatement. To achieve the same result through regulation, the regulator would need to differentiate regulated limits for each class of polluters on the basis of the relative costs for pollution reduction. This would be complex, and regulators are unlikely to have the required information.

Furthermore, the social costs of damage could be incorporated into "benefit-cost" analyses of proposed system investments, to give appropriate weight to environmental concerns in comparisons of investments among modes (and between transport and other activities).

Thus, the simple prescription for achieving an efficient level of damage mitigation is to identify the costs imposed by the environmental damage that are attributable to each mode, and to incorporate them in user-charges.

### 5.1.2 Can Damage Costs be Estimated?

Many would counter that it is not possible to estimate costs for many aspects of damage, as does Environment Canada in its discussion paper on economic instruments.[42] The difficulties of determining costs have defeated most attempts to date, beyond some simple valuations of damages to materials or crops, when the damage is unequivocal and a market price can be referred to for its value. Two problems, respectively of science and economics, have proven intractable:

- identifying the damage caused by a unit of transport (passenger-kilometres/trip/mode); for example, by determining the extent to which people, plants and animals are harmed by transport emissions, noise or community disruption; and
- attributing money values to the damage.

It seems likely that scientific techniques will improve, though the medium-term prospects for improvements are limited, especially for quantification of the health effects. Some economists believe that there has been great progress recently in attributing money values for damage through such techniques as asking individuals what they would pay in hypothetical trading situations for improvements in environmental conditions.[43] When structured carefully, these experiments are impressive, and a growing body of social scientists finds them credible. While it might be credible, however, to use resulting values in cost-benefit analyses of control measures (in which analytical techniques can overcome experimental uncertainty), the hypothetical nature of these values would pose very substantial problems of public credibility if attempts were made to base prices on them.

It is also possible in some cases to estimate the costs of cleaning up environmental damage, which might provide a proxy for the social cost of the damage itself, and a basis for charging the polluters. In Europe, some public agencies charge companies for the treatment costs of chemical discharges into waterways.[44] It has been suggested that the principle might be applicable to global warming damage, estimating the costs to mitigate flood damage from rising sea levels, for example (and possibly basing charges for $CO_2$ emissions on them). The principle, however, is by no means applicable to all types of environmental damage, as some types are completely irreversible (for example, the loss of a species), while for others, including air pollution, there are no clean-up options.

Problems of valuing noise damage are arguably less difficult than those for air pollution, because the sources and effects are easier to measure — particularly in the case of aircraft noise — and also because individual behaviour to avoid or accommodate noise is easier to measure. Nevertheless, considerable ingenuity is still required to infer values for noise, for example, from the effects of noise on house prices.[45]

### 5.1.3 Alternative Bases for Setting Emissions Charges

*Costs to achieve pollution reduction targets:* When national or international targets for pollution reduction are accepted, predictions of average reactions of transport users to changes in prices may indicate the level of emission charge that needs to be imposed to reach the goal. For example, it should be possible to examine the national $NO_x$ goal and to infer the emissions surcharge on gasoline that would be needed to achieve the required reduction in that sector. It should also be possible to extend the analysis to consider what combinations of surcharges on the various fuels or engines might be needed throughout the transportation sector, and to do the same for all other sectors, in order to design a broad strategy.

While such an inferential procedure does not directly use the information available on the extent and value of environmental damage, this information will likely be assessed by policy makers in setting the national goals. The charges inferred to meet the goals would then also be based implicitly on that information.

Such inference of charges required to meet goals is the focus of much recent discussion of carbon taxes. Predictions of the reactions of industry and the public to such taxes in the United States have suggested that carbon taxes might need to be between about US$100/t and US$400/t of carbon to reach the Toronto Conference goal of 20% reduction in $CO_2$ by 2005.[46] Similar modelling in Canada has suggested that achieving the extra 15% reduction in $CO_2$ needed to meet the national stabilization goal in 2000 would necessitate a tax of about $120/t of carbon. This would amount to 7.7¢/L of gasoline, and 9¢/L of diesel fuel.

The appropriate goal for $CO_2$ reduction remains the subject of great debate, and of international negotiations.[47] Some economists reject the proposals for carbon taxing on the scale required to stabilize $CO_2$ emissions at 1990 levels, or to meet the Toronto Conference goal of a 20% reduction, arguing that it is not necessary at present to adopt an arbitrary goal that is expensive to meet. The U.S. studies mentioned earlier suggest that the annual costs of achieving the Toronto goal through carbon taxing would range from about 1% to 3% of gross national product. It can be argued that efforts might, at present, be better directed at defining more clearly the nature of the effects of global warming, and therefore the magnitude of the benefits to be gained from its control, and also at developing means to reduce emissions more cheaply in future.[48] Proponents of this view suggest that a modest carbon tax be introduced in the interim in order to steer behaviour toward conservation and substitution of energy use.

Resolving these differing judgements of the appropriate levels of charges requires enhanced understanding of the nature and costs of global warming, further objective analysis of the cost-effectiveness of control options, and careful modelling of producers' and consumers' reactions to charges in all relevant sectors of the economy.

*Costs of damage implicit in previous regulatory decisions:* Adoption by government of environmental damage regulations involves either explicit or implicit acceptance of its cost-effectiveness, in costs per unit of damage prevented. It can be inferred that the government believes the cost of the regulation per unit of damage prevented to be somewhat less than the social costs the damage would impose (otherwise they would prefer the damage). By extension, it could be argued that the implied unit cost of the regulation provides a minimum social cost to be used as a basis for setting charges for remaining emissions. This has been the argument used in Sweden, where a parliamentary agency endorsed the use as emissions charges of values per unit of emissions implicit in a previous decision to impose a motor-vehicle equipment regulation.[49]

An analogous inference could be made in Canada from the 1987 motor-vehicle emission standards, for example, that the cost per tonne of $NO_x$ reduction was about $2,000.[50] If this is a reasonable charge for remaining $NO_x$ emissions, it would imply a surcharge of about 0.12 cents per kilometre for cars, or 1 cent per litre of gasoline, and 0.74 cents per kilometre for heavy trucks, or about 1.2 cents per litre of diesel. Such charges should, of course, be extended logically beyond the transport sector.

## 5.2. TRADEABLE EMISSIONS PERMITS

### 5.2.1 Description[51]

The essence of a permit system is that the total amount of allowable emissions is determined in advance by the regulatory agency. Permits are then issued (donated or sold) only up to that limit, and they can be traded among emitters of pollution. The system is intended to introduce some flexibility compared with the customary regulatory procedure in which the emissions of every company are specified by the regulator. Under the permit system, if there are substantial differences in costs of meeting the standards among companies, one with high costs can effectively choose to pay a low-cost company to reduce emissions instead, by the device of buying the latter's permits. If the high-cost company pays a price for the permits lower than its own costs of abatement but higher than those of the low-cost company, both companies are better off by the trade, as is the economy as a whole. The regulator's goal of the specified emissions limit is achieved, but at a lower cost than if the companies were required to abate equally.

If each company faces the same cost structure, there will be no trades, and if there are substantial costs in organizing trades, they might wipe out the potential gains. Alternatively, the scheme might be frustrated by low-cost firms refusing to trade, in order to gain a competitive advantage, or by high-cost firms choosing not to buy permits, to avoid public censure. In any of these cases, a permit scheme reverts to being a customary regulation. Therefore, permit schemes will, at worst, impose the same costs as regulations, and offer the prospect of achieving emissions reductions more cost-effectively.

### 5.2.2 Potential Relevance of Tradeable Permits to Transportation Emissions

No workable system of tradeable permits for individual transport vehicles has been designed. The flexibility of vehicle use, and therefore the unpredictability of their emissions in any specified time period, makes it difficult to envisage a permit system that is not also an administrative nightmare. For example, consider the case of $NO_x$ emissions, which arise from many different types of processes, with major differences in the costs of abatement (for example, between pulp mills, power plants, passenger cars and diesel trucks). Cost-effectiveness comparisons show it could be cheaper for car drivers to pay for $NO_x$ reductions in pulp mills than to obtain the equivalent reduction by buying Californian engine controls (or being forced to do so by a regulation).[52] But to address this with a permit system would require issuing and then monitoring trades in large numbers of permits for the very small amounts individuals would need (for example, an estimated vehicle-year's emissions or a vehicle-lifetime's emissions).

Alternatively, permits could be issued to vehicle manufacturers for their whole production fleet, allowing them to trade with other sources.[53] This would require manufacturers to take responsibility for the lifetime use of vehicles, so the requirements for monitoring by the regulatory agency (or the manufacturers) would still be stringent.

There would seem to be greater potential to design trading schemes that involved rail or air carriers, with fewer participants, and more predictable and monitorable emissions, but the payoff would not be great due to the relatively small total contributions of these modes to total emissions.

Some less ambitious variants of tradeable permits might be more feasible, and preferable to simple customary regulation in allowing more flexibility and lower compliance costs. An example might be to allow trading at least within an individual company. Rather than setting targets for each unit of production, a company-wide target would be set, and the company could meet the target however it pleased. Such corporate targets are the chosen means of regulating motor-vehicle fuel consumption, where the manufacturer meets a sales-weighted average consumption across all models, but, conspicuously, not for motor-vehicle emissions standards, in which each model must meet the same standard (in grams per kilometre). The government could obtain the same aggregate performance from each manufacturer with a corporate average emission rate, while allowing manufacturers the flexibility to achieve this at lowest cost by focussing on models in which abatement is cheaper (avoiding expensive re-design of old models, for example). Furthermore, if the target is expressed this way as an average emission rate (rather than total emissions from the vehicles concerned, with all the attendant problems of controlling vehicles over their lifetime), it becomes more reasonable to consider trading of those emissions rights among manufacturers. Companies producing predominantly cleaner (smaller) cars would sell their rights to those producing more-polluting (larger) ones.

## 5.3 EQUITY ISSUES IN ECONOMIC INSTRUMENTS

Environmental damage from transportation is arguably largely unfair, in that those harmed are usually not responsible, and are usually not compensated for damage. Furthermore, to the extent that regulations are inefficient through requiring the same emissions reduction (and its costs) to be borne by all, when the effects differ by location, those who do not travel in sensitive areas are unfairly penalized. Emissions charges that forced polluters to pay, and were differentiated by amounts of damage, would be fairer.

Emission charges, however, that were consistent across the modes — the same for each unit of pollutant — might pose some thorny equity questions. Current evidence suggests emissions are higher per passenger-kilometre by train than by car (discussed later in this chapter); therefore, charges per passenger would be higher for rail passengers than car passengers. It would be argued that such charges were regressive. Also, of course, the higher emissions for trains reflect current equipment and load factors, which rail passengers would be quick to claim were beyond their responsibility.

The equity implications of extending emissions charges to urban transportation would also be important. Charging car users for their emissions, through surcharges on gasoline taxes or registration fees, would be characterized as tax hikes, and viewed with suspicion because of their possibly regressive effects. In the case of poorer residents of our largest cities, if they were forced by circumstance to drive older, more-polluting cars, they would face surcharges higher than those in the surrounding areas, and higher than the average, and yet they would also be subject to the worst of the city environment themselves.

Similarly, introducing a carbon tax for $CO_2$ control would raise the question of its incidence by income group, and also by province or region, as its implications for electricity pricing became clear.

Finally, the emissions permit trading systems would have some equity implications, in apparently allowing permit buyers to meet lower pollution limits than permit sellers. (In other words, vehicle manufacturers might buy permits rather than reduce emissions in larger vehicles or older designs.) This might be perceived as unfair (though a strong counter-argument would be that such permit buyers are meeting the same standards, but choosing to do so by paying for emission reduction to be gained more cheaply elsewhere).

### 5.3.1 Uses of Revenues from Charges/Permits

As the charges would be payments for the social costs of environmental damage, Chapter 7 of Volume 1 of this report recommends that they should be paid to the government(s), rather than to the owners of the infrastructure (if separate agencies), and should not be used for system development. Charges might be used to pay for cleaning up the damage, in the limited cases where that is possible, or for compensating victims of damage, in the cases where they might be identifiable (which seems remote in the case of most air pollutants or for global warming). The remainder would probably constitute large amounts of new revenue to governments. There seems no compelling argument for earmarking these revenues for general use in environmental programs outside transport (as some environmental advocates have proposed).

## 6. Illustrations of the Possible Costs of Damage from Emissions and of the Potential Magnitude of Emissions Charges

Attempts are made later to illustrate the possible magnitude of costs of damage for each of the intercity passenger modes on a comparable basis. The system-wide averages per passenger-kilometre are provided, as are totals for two sample trips. It is supposed that the estimated damage costs could provide a basis for setting charges by mode.

The detailed design of environmental charges would be a complex effort, because the transfers of money involved on a national scale are potentially very large. The Royal Commission has not attempted the task, because the effects of possible charges on all damage sources would need to be predicted and judged, and these sources extend considerably beyond the transportation sector. This task should be undertaken by the departments of federal, provincial and territorial governments responsible for transport, environment, energy and finance.

All sources of environmental damage should be considered, possibly including disruption of social activities and other forms of "disamenity" experienced by those in proximity to transport facilities, as well as the more obvious forms of discharges and pollution. For the present, some hypothetical possibilities of charges are offered here based only on the damage from emissions of $CO_2$, $NO_x$ and VOCs, together with aircraft noise, to illustrate the potential magnitude of surcharges, and how they might differ by mode. These are obviously not the only sources of environmental damage, but are possibly the most important, and are also those on which some scant information on possible costs is available.

Other components of emissions have been purposefully ignored. Carbon monoxide and particulate emissions are assumed irrelevant for intercity trips, as their damage is essentially urban, and $SO_2$ emissions from transportation are assumed to be so small a proportion of total national $SO_2$ emissions as to be negligible. These assumptions might prove incorrect when detailed design of potential charges was undertaken.

## 6.1 AVERAGE COSTS OF ENVIRONMENTAL DAMAGE FROM AIR POLLUTANTS AND $CO_2$ BY MODE

There are no convincing estimates of the average costs of environmental damage from $CO_2$, $NO_x$ and VOCs. In preparing the Royal Commission's estimates of comprehensive costs by mode, it has therefore been assumed that the charges necessary to achieve nationally declared goals for these emissions reflect the social value placed on preventing the damage. For $CO_2$, reviews were made of estimates in the United States and Canada of the prices that would be necessary to stabilize total $CO_2$ emissions from all sources at 1990 levels in 2000. In Canada, modelling has suggested that the necessary price is about $120/t of carbon, which is equivalent to $32.70/t of $CO_2$, or 3.27¢/kg (in 1991 dollars). This is used here as an estimate of the environmental damage from $CO_2$.

For $NO_x$ and VOCs, no similar modelling appears to have been undertaken of the charges that might be sufficient to meet Canada's announced goals. At present, therefore, the charges can only be guessed to illustrate the costs and potential charges if the Royal Commission's recommendations are implemented. The task of making reliable estimates (or estimating damage losses from these emissions in some other manner) would be an initial priority in implementing the proposals.

The guesswork is guided by the $NO_x$/VOCs Management Plan, which produced some (very rough) estimates of the cost-effectiveness of a number of its proposed policies, in cost per tonne of emission prevented.[54] Measures considered acceptable in the Plan — various technological controls and limitations on activities — have an upper limit of cost of about $3,000 per tonne of either emission prevented (in 1989 prices). These measures in total are not sufficient to achieve Canada's recently announced goals for $NO_x$ and VOCs reductions, so it can be deduced that to succeed in achieving them would require measures costing more than $3,000 per tonne. An initial guess is that such measures might cost $5,000 per tonne (in 1991 prices). (It is noted that measures are under consideration in the United States that would cost several times this amount per tonne of VOCs prevented.)[55] Then it can be suggested that the goals could alternatively be achieved through setting a price of that same amount of $5,000 per tonne, from rough reasoning that such a price would induce manufacturers and consumers to take advantage of all possible control measures and behavioural changes that cost less than $5,000 per tonne. In support of these prices, it should be noted that the prices introduced in Sweden for $NO_x$ and VOCs emissions amount apparently to about US$7,150 per tonne of $NO_x$ and about US$3,550 per tonne of VOCs.[56]

Whether the prices for $NO_x$ and VOCs should be equal in Canada should also be addressed in implementing the Royal Commission's proposals. For the present, it should be noted that the question of the relative contributions of the two types of emissions to low-level ozone formation in Canada's ozone-sensitive regions has not been definitively answered, though the $NO_x$/VOCs Management Plan suggests pursuing both $NO_x$ and VOCs reductions with equal urgency. The Plan also implicitly endorses an equal value for damage in proposing the adoption of measures with the same upper limit on cost-effectiveness per tonne. For illustrative purposes, the value of $5,000 per tonne ($5 per kilogram) is used in the Royal Commission's costing for both $NO_x$ and VOCs.

It must also be decided whether the damage costs and any prices that emerge from these costings apply equally throughout Canada. It is clear from Environment Canada and CCME decisions that the effects of low-level ozone are considered much worse within the three ozone-sensitive regions now designated as requiring special attention — the Lower Fraser Valley, Windsor to Quebec City corridor and southeastern New Brunswick. It is assumed for illustrative purposes that the costs of damage arise from emissions of $NO_x$ and VOCs only in those regions. Estimates must therefore be made of the proportions of total emissions by mode that arise within the sensitive regions. From the Canadian Travel Survey for 1988, it was reported that about 70% of the car-kilometres in long-distance trips were driven within the provinces of British Columbia, Ontario, Quebec and New Brunswick. It is guessed that the proportion of that travel, and its fuel and emissions, within the ozone-sensitive regions was around 70%, so about 50% (70% of 70%) of national intercity car traffic was within those regions. The damage cost of $5,000 per tonne of $NO_x$ and VOCs is therefore applied to 50% of the average national emissions by car per passenger-kilometre. Similarly, the proportions of bus and train fuel use and emissions within the sensitive regions are guessed to also be 50%, while that of aviation emissions is guessed at 20%. (The average $NO_x$ and VOCs emissions from aircraft are low relative to the other modes and also relative to aircraft $CO_2$ emissions, so the margin of error in the final estimate of the damage costs for aircraft is relatively unimportant.) For ferries, it is assumed that none of the emissions are within the sensitive regions (which ignores ferry contributions to problems in southern British Columbia and around Saint John, New Brunswick).

Furthermore, the focus must be on those periods when the emissions are most damaging. Concentrations of ozone exceeding the maximum acceptable NAAQO occur primarily in the summer months, in episodes lasting a few hours or days. It is assumed that charging \$5,000 per tonne for $NO_x$ and VOCs only during the summer season would prompt adoption of measures that achieve the goals. Costs are therefore counted only for the emissions in that season. Monthly counts from the Canadian observation stations of episodes in which ozone exceeds the maximum acceptable NAAQO show that they are concentrated in the months of May to August.[57] The target season for ozone charges is therefore defined as May to August. Within those four months, it is assumed (based roughly on fuel sales by month) that emissions in each mode account for 40% of the annual total.

Finally, applying the above values of \$32.70 per tonne of $CO_2$, and \$5,000 per tonne of $NO_x$ or VOCs within the ozone-sensitive regions, to 40% (summertime proportion) of the emissions per passenger-kilometre by mode in Table 7(2)-3, the following system-wide average costs of emissions per passenger-kilometre by mode are obtained (and used in the system-wide average costing in Volume 1, Chapter 3 of this report).

*Table 7(2)-7*

*Estimated Costs of System-Wide, Year-Round Emissions per Passenger-Kilometre (1991 cents per passenger-kilometre)*

| Mode | $CO_2$ | $NO_x$/VOCs | Combined |
|---|---|---|---|
| Bus | 0.169 | 0.077 | 0.246 |
| Car | 0.410 | 0.166 | 0.577 |
| Train | 0.382 | 0.259 | 0.642 |
| Airplane | 0.899 | 0.022 | 0.921 |
| Ferry | 1.972 | 0.000 | 1.972 |

## 6.2 ILLUSTRATION OF POTENTIAL MAGNITUDE OF EMISSIONS CHARGES FOR SAMPLE ROUTES

The examples used in Volume 1, Chapter 7 are for the trips from Toronto to Montreal and Saskatoon to Halifax. To estimate the environmental damage, the first step is to estimate the amounts of emissions by mode for each of the trips. The emissions per unit of fuel energy used in each mode are expected to remain as shown in Table 7(2)-1, but the emissions per passenger-kilometre are expected to differ from the system-wide averages shown in Table 7(2)-3 because equipment and load factors vary by route for the public modes, and so, therefore, do the amounts of fuel used per passenger-kilometre. Royal Commission staff estimates of the amount of fuel required per passenger-trip (consistent with the vehicle/carrier costing elsewhere in this report) are shown in Table 7(2)-8.

*Table 7(2)-8*

*Fuel Use per Passenger-Trip by Mode, for Sample Routes (litres/passenger-trip)*

| Mode | Toronto to Montreal | Saskatoon to Halifax |
|---|---|---|
| Bus | 5.9 | 67 |
| Car | 28.9 | 240 |
| Train | 15.0 | 283 |
| Airplane | 40.8 | 219 |

Multiplying the energy used in megajoules per passenger-kilometre (using values from Table 7(2)-2) by the ratios of emissions to energy use by mode (in Table 7(2)-1) provides measures of the emissions of $CO_2$, $NO_x$ and VOCs per passenger-kilometre. These values are shown in Table 7(2)-9, for the two sample routes. (This table appears in a slightly different form in Chapter 7 of Volume 1 as Table 7-1.)

*Table 7(2)-9*
*EMISSIONS PER PASSENGER-KILOMETRE (GRAMS)*

| **Toronto to Montreal** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | **If all seats filled** | | |
| | **Car** | **Bus** | **Train** | **Airplane** | **Bus** | **Train** | **Airplane** |
| CO | 5.20 | 0.18 | 0.34 | 0.17 | 0.14 | 0.21 | 0.11 |
| VOCs | 0.94 | 0.05 | 0.14 | 0.10 | 0.04 | 0.09 | 0.07 |
| $NO_x$ | 0.75 | 0.40 | 1.54 | 0.34 | 0.31 | 0.96 | 0.23 |
| $CO_2$ | 128.0 | 30.0 | 76.0 | 220.0 | 23.0 | 47.0 | 148.0 |
| Load factor | | 0.77 | 0.62 | 0.675 | 1.00 | 1.00 | 1.00 |
| **Saskatoon to Halifax** | | | | | | | |
| | | | | | **If all seats filled** | | |
| | **Car** | **Bus** | **Train** | **Airplane** | **Bus** | **Train** | **Airplane** |
| CO | 5.20 | 0.24 | 0.77 | 0.13 | 0.14 | 0.54 | 0.09 |
| VOCs | 0.94 | 0.07 | 0.32 | 0.08 | 0.04 | 0.23 | 0.05 |
| $NO_x$ | 0.75 | 0.54 | 3.52 | 0.26 | 0.31 | 2.46 | 0.17 |
| $CO_2$ | 128.0 | 41.0 | 173.0 | 167.0 | 23.0 | 121.0 | 113.0 |
| Load factor | | 0.57 | 0.7 | 0.675 | 1.00 | 1.00 | 1.00 |

**Sources: Emissions per unit fuel from VHB Research & Consulting, "Environmental Damage from Transportation." Fuel consumption per pass-km estimated by Royal Commission staff.**

As noted, the emissions rates depend on the assumed load factors of the public modes, shown for each route in the final row of Table 7(2)-9. To show the importance of the load factors, the table also shows the potential emissions per passenger-kilometre if all seats were filled. No load factor for cars is shown, but the assumed car occupancy of about 1.8 implies a load factor of only 35%. Filling all car seats could then potentially reduce car emissions per passenger-kilometre by about 65%.

To estimate the damage costs, and potential emissions charges to recuperate them, the total emissions per passenger-trip are estimated, as shown in Table 7(2)-10. The table indicates the trip distances by mode, and total emissions of $CO_2$, $NO_x$ and VOCs per passenger-trip. However, as discussed, the emissions of the ozone precursors, $NO_x$ and VOCs, are assumed to produce damage only when released in the ozone non-attainment areas. The table therefore indicates the distance by each mode that is assumed to take place within such areas. For the Toronto to Montreal trip, all of the surface routes are within the Windsor to Quebec City corridor, while for the Saskatoon to Halifax trip, only those parts of the trip within that ozone non-attainment area and the one in southeastern New Brunswick are included.

*Table 7(2)-10*
*EMISSIONS PER PASSENGER-TRIP (GRAMS)*

| Toronto to Montreal | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | km in ozone-sensitive areas | Total emissions | | | In sensitive regions | |
| | km | | $CO_2$ | $NO_x$ | VOCs | $NO_x$ | VOCs |
| Car | 539 | 539 | 68,933 | 406 | 508 | 406 | 508 |
| Bus | 539 | 539 | 16,243 | 215 | 28 | 215 | 28 |
| Train | 540 | 540 | 41,027 | 833 | 77 | 833 | 77 |
| Airplane | 496 | 340 | 108,902 | 169 | 52 | 116 | 35 |

| Saskatoon to Halifax | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | km in ozone-sensitive areas | Total emissions | | | In sensitive regions | |
| | km | | $CO_2$ | $NO_x$ | VOCs | $NO_x$ | VOCs |
| Car | 4,485 | 650 | 573,586 | 3,380 | 4,225 | 490 | 612 |
| Bus | 4,485 | 650 | 183,522 | 2,431 | 312 | 352 | 45 |
| Train | 4,468 | 400 | 774,859 | 15,724 | 1,449 | 1,408 | 130 |
| Airplane | 3,500 | 559 | 585,081 | 906 | 277 | 145 | 44 |

**Sources: Emissions per unit fuel from VHB Research & Consulting, "Environmental Damage from Transportation." Fuel consumption per pass-km and route distances estimated by Royal Commission staff.**

For the airplane trips, it is assumed that the emissions at cruising height are too high to contribute to low-level ozone concentrations. An estimate of the emissions that do contribute to low-level ozone is obtained using the constant term from the fuel consumption equation used in the air carrier costing model. Approximately 35 L per aircraft trip is constant over a trip of any distance, contributing to low-level ozone through climbing, descending, taxiing and idling. The figures in Table 7(2)-10 for airplane-trip "kilometres in ozone-sensitive zones" are obtained by expressing 35 L as a proportion of total fuel used per passenger-trip, and multiplying this by total trip distance.

The illustrative emissions charges are then obtained by multiplying the $CO_2$ emissions in Table 7(2)-10 by 3.27¢/kg, and the $NO_x$ and VOCs emissions in the sensitive regions by $5/kg. The results are shown in Table 7(2)-11, which appears (with rounded values) as Tables 7-2 and 7-3 in Volume 1, Chapter 7.

*Table 7(2)-11*

*ILLUSTRATIVE EMISSIONS CHARGES (DOLLARS PER PERSON-TRIP)*

| | Toronto to Montreal | | | |
|---|---|---|---|---|
| | **Winter** | **Summer** | | |
| | **$CO_2$ charge** | **$CO_2$ charge** | **$NO_x$/VOCs charge** | **Total charge** |
| Car | 2.25 | 2.25 | 4.57 | 6.82 |
| Bus | 0.53 | 0.53 | 1.21 | 1.75 |
| Train | 1.34 | 1.34 | 4.55 | 5.89 |
| Airplane | 3.56 | 3.56 | 0.76 | 4.32 |
| | **Saskatoon to Halifax** | | | |
| | **Winter** | **Summer** | | |
| | **$CO_2$ charge** | **$CO_2$ charge** | **$NO_x$/VOCs charge** | **Total charge** |
| Car | 18.76 | 18.76 | 5.51 | 24.27 |
| Bus | 6.00 | 6.00 | 1.99 | 7.99 |
| Train | 25.34 | 25.34 | 7.69 | 33.03 |
| Airplane | 19.13 | 19.13 | 0.94 | 20.08 |

**Source: Royal Commission staff estimates. See text.**

## 6.3 ESTIMATES OF ENERGY USE AND EMISSIONS BY HIGH-SPEED RAIL

The estimates of possible emission charges for high-speed trains in Volume 1, Chapter 7 of the report are based on the following analysis.

### 6.3.1 Energy Use

Estimates of the energy requirement for a service like the "train à grande vitesse" (TGV), operating in the Windsor to Quebec City corridor (at 300 km/h), are available as follows:

The power required from the electricity grid into the rail system is estimated by Lake et al. as:[58]

- 0.083 kilowatt-hours (kWh) per passenger-kilometre,
- where 1.0 kWh equals 3.6 MJ.

In other words, the service would require 300 kJ of energy per passenger-kilometre.[59]

Khan's report[60] quotes Johnson et al.[61] for an estimate of the power required from the electricity grid as:

- 275 kJ/seat-kilometre.

The estimated average train occupancy on the proposed Toronto to Montreal route is:

- 75%.

This means that:

- 370 kJ of energy per passenger-kilometre would be used.

Khan also considers the source of the electricity. He estimates that the combined electricity output of Ontario and Quebec is provided approximately 55% by hydro-electricity plants and 45% by thermal (including nuclear) plants. He suggests that of the "primary" fuel used for the thermal plants, 3.6% is required to process and transport the fuel to generating plants, and up to 70% is lost in the generation process. For either thermal or hydro-electricity, he suggests 15% of power supplied by the plants is lost in transmission and delivery within the rail system. In sum, he estimates that, on average in the two provinces, only 55% of "primary" energy (electricity from the hydro plants, or initial fuel for thermal plants) reaches the trains. Therefore he suggests that the 275 kJ/seat-kilometre in "secondary" energy requires (275/0.55 =) 500 kJ/seat-kilometre in "primary" energy. Using his 75% average train occupancy, this equals an energy requirement of 670 kJ/per passenger-kilometre.

The report of the Ontario/Quebec Rapid Train Task Force[62] quotes estimates made by Ontario's Ministry of Transportation of "overall energy efficiency" of current modes and future options for high-speed rail and magnetic levitation (maglev) trains, including the following kilowatt-hours per passenger-kilometre for the 300 km/h TGV Atlantique or ICE in a Windsor to Quebec City corridor service.[63] The final column converts these to kilojoules per passenger-kilometre.

| | kWh/pass-km | kJ/pass-km |
|---|---|---|
| Windsor to Toronto | 0.10–0.12 | 360–430 |
| Toronto to Montreal | 0.09–0.11 | 320–400 |
| Montreal to Quebec City | 0.11–0.13 | 400–470 |

It is not clear whether these estimates refer to "secondary" or "primary" power requirements, but it seems likely they are the power requirements of the rail system from the electricity grid.

### 6.3.2 Synthesis

These estimates lie in the range of 300 to 470 kJ/pass-km for all of the corridor services. For the Toronto to Montreal route, the estimates are 300 kJ/passenger-kilometre from Lake et al., 370 kJ/pass-km from Khan, and the range of 320 to 400 kJ/pass-km from the Ontario/ Quebec Rapid Train Task Force. An approximate mean of this range, for the purpose of showing the possible magnitudes of energy and emissions from high-speed trains relative to current modes, is 350 kJ/passenger-kilometre.

To the extent that the electricity was provided from fossil-fuel-fired plants, a conversion from "secondary" energy requirements to "primary" requirements is necessary, along the lines suggested by Khan. Khan's estimates of the average losses of energy in generation, however, are probably too pessimistic in their assumption that about 75% of Ontario's power comes from thermal stations with average conversion efficiency of 30%. For the present main purpose of comparing emissions from high-speed trains with those from other modes, the prime interest is in the amount of fossil fuel that might be used to generate the electricity. The conversion efficiency is only of relevance to the extent that the high-speed rail system would be supplied from fossil-fuel-fired plants. The current contribution of such plants in Ontario and Quebec is shown in Table 7(2)-12.

*Table 7(2)-12*

*SOURCES OF ELECTRIC POWER GENERATION IN ONTARIO AND QUEBEC, 1991*

| | Ontario | | Quebec | |
|---|---|---|---|---|
| **Source** | (GWh) | (%) | (GWh) | (%) |
| Hydro | 37,441 | 26.6 | 137,867 | 97.1 |
| Conventional steam | 31,483 | 22.4 | 264 | 0.2 |
| Nuclear | 70,773 | 50.3 | 3,910 | 2.7 |
| Other | 1,001 | 0.7 | (negligible) | |
| **Total** | **140,698** | **100.0** | **142,041** | **100.0** |

**Source: Statistics Canada, Catalogue No. 57-001.**

The "conventional steam" plants and the "other" plants in Ontario are fired by fossil fuels. Of the combined total for the two provinces, therefore, these provided some 11.6% of electricity generated in 1991. This proportion can be expected to decrease in the future, if plans are implemented in Quebec to increase its hydro-electric output and in Ontario to increase its nuclear output.[64]

The extent to which a high-speed rail system would in practice draw on the fossil-fuel-fired plants would depend on the production conditions at the time its demands were made. For certain trains at peak electricity demand times, it is possible that all of the marginal power used would be generated by the fossil-fuel-fired plants, while for others at off-peak times the marginal power would come entirely from hydro-electric or nuclear plants. For a simple illustration of the potential emissions, no attempt is made to predict the exact outcome, but the simple assumption is made that a high-speed rail system at the end of the current decade would draw from the electricity grids of Ontario and Quebec in an average manner. It could then be expected to receive about 10% of its electricity from fossil fuels. Recognizing that losses in generation in fossil-fuel-fired plants amount to 50% to 70% of total energy input, the "primary" fuel requirement to those generation stations can be estimated conservatively to be of the order of double the above rate per passenger-kilometre, or about 700 kJ/pass-km. The illustrations of potential emissions from high-speed rail that follow use these average assumptions: 10% of the electricity required for the trains is generated using fossil fuels, at an average energy intensity of 700 kJ/pass-km.[65]

### 6.3.3 Emissions

For comparisons with the environmental costs of other modes, all of the environmental impacts expected from each should be strictly accounted for. Due to the uncertainties of damage cost estimation, the cost analyses by mode are limited to those effects expected to be of most importance from intercity passenger transportation: the emissions of $CO_2$, $NO_x$ and VOCs. When considering the case of high-speed rail, only costs for emissions of $CO_2$ and air pollutants are shown, so only the fossil-fuel-fired portion of the electricity used is relevant. No costs are added for the other potentially important categories of environmental effects from hydro-electricity plants and nuclear generating stations.

The emissions of interest and importance from fossil-fuel-fired plants are $CO_2$, $NO_x$ and also $SO_2$. Sulphur dioxide is important because it damages health by aggravating respiratory complaints such as asthma and bronchitis, and because of its major contribution to acid rain. While $SO_2$ is produced in all combustion processes, the amounts created from fuel use by current intercity passenger transportation are considered sufficiently small, and their emissions sufficiently remote from sensitive populations, that no cost was assigned to them in the cost analyses in the earlier sections. However, the $SO_2$ from fossil-fuel-fired electricity plants is of sufficient importance that an attempt should be made to assign a cost to it, as has been done with $NO_x$ and VOCs.

Table 7(2)-13 shows the main components of the cost analysis:

Column 1 illustrates the emissions per unit of energy used in these plants:

- Emissions of $CO_2$ can be estimated from the carbon content of coal (assuming Canadian bituminous coal is used in power plants) as 92.1 g/MJ.[66]
- Emissions of $NO_x$ and $SO_2$ can be estimated from average rates forecast by Ontario Hydro for 1996 to 2000,[67] of 1.612 g/kWh of $NO_x$, and 4.0 g/kWh of $SO_2$. These convert to 0.448 g/MJ of $NO_x$ and 1.11 g/MJ of $SO_2$.

Column 2 shows the estimated energy requirement from fossil-fuel-fired plants of 700 kJ per passenger-kilometre.

Column 3 lists the grams of emissions per passenger-kilometre, which is the product of the previous two columns.

Column 4 shows the estimated costs per tonne of emissions. The amounts for $CO_2$ and $NO_x$ are as used throughout this environmental cost analysis, from amounts assumed to be necessary to meet national goals, of $120 per tonne carbon, or $32.70 per tonne $CO_2$, and $5,000 per tonne $NO_x$, when emitted in summer. The estimated cost of $SO_2$ is obtained from the report by VHB for the Royal Commission,[68] derived in turn from a review of cost estimates by Ottinger et al.[69] The cost is quoted as $5.29/kg in 1989 prices, which is inflated to 1991 prices, and converted to an estimate of $6,000 per tonne.

Column 5 estimates the costs in cents per passenger-kilometre, obtained as the product of columns 3 and 4.

*Table 7(2)-13*

*COSTS OF EMISSIONS FROM FOSSIL-FUEL-FIRED ELECTRICITY PLANTS, FOR HIGH-SPEED RAIL (1991 PRICES)*

| | g/MJ | kJ/pass-km | g/pass-km | | Cost ($/tonne) | Cost (¢/pass-km) |
|---|---|---|---|---|---|---|
| $CO_2$ | 92.10 | 700 | 64.50 | | 33 | 0.21 |
| $NO_x$ | 0.45 | 700 | 0.31 | summer | 5,000 | 0.16 |
| | | | | other seasons | 0 | 0.00 |
| $SO_2$ | 1.11 | 700 | 0.78 | | 6,000 | 0.47 |
| **Total** | | | | | **summer** | **0.84** |
| | | | | | **other seasons** | **0.68** |
| | | | | | **average** | **0.74**[a] |

**a. Assuming summer emissions are 40% of the annual total.**

The emissions costs are thus estimated to range between zero, when the electricity is generated from non-fossil sources, to about 0.73 cents per passenger-kilometre when the electricity is entirely from fossil fuel. Then it remains to estimate average costs per passenger-kilometre for electricity used in high-speed rail, given the proportion of the power to be provided by fossil-fuel-fired plants. As noted earlier, the assumption is made that this proportion will, on average, be the same as the contribution of fossil-fuel-fired plants to total electricity generated in Ontario and Quebec: about 10%. The final estimated costs of the emissions from high-speed rail are therefore approximately

(10% of 0.84¢ =) 0.08¢/pass-km in summer, and 0.07¢/pass-km in the rest of the year. A rounded estimate of the year-round average, with about 40% of fuel use in summer, would be 0.07¢/pass-km.

## 6.4 ESTIMATES OF AIRCRAFT NOISE COSTS

Costs for aircraft noise are included in the system-wide costs and costs for sample routes in Chapters 3 and 18 of Volume 1 of this report, based on the following information.

Estimates of the costs of noise at Toronto and Vancouver airports are obtained from Gillen and Levesque.[70] The authors infer values of noise nuisance from those airports, and estimate noise costs for various models of aircraft. Their findings imply that there are substantially greater costs for "Stage 2" aircraft than for those with "Stage 3" noise controls. For example, the cost per movement for a B767-200 is $89 at Lester B. Pearson International Airport in Toronto compared with $123 for a B737-200 and $138 for a DC9-30. The costs are somewhat different at Vancouver from those at Pearson, and no simple averages for all types of aircraft are presented. For purposes of illustration, however, only orders of magnitude are necessary, and it is apparent from the tables that the cost per seat-movement is somewhat above $1.00 for the older aircraft, and below $0.50 for the newer models. Taking average occupancies into account, it will be assumed that it is reasonable to represent noise costs at these two airports as $1.00 per person-movement, in round figures (a figure somewhat higher than the source tables would suggest).

Then it is assumed that similar noise costs hold at Montreal's Dorval Airport, but that noise costs are otherwise negligible at Canadian airports. (This is not realistic but possibly counters the overstatement of costs at the main airports.) These three major airports account for 60% of total enplaned/deplaned passengers in Canada (including international passengers). It is therefore assumed that noise costs are, in very rounded figures, closer to $0.50 per passenger-movement nation-wide, or $1.00 per passenger-trip. This cost is included in the estimates of system-average environmental damage costs in Volume 1, Chapter 3 of this report, and for the costs of the sample routes, the costs are assumed to occur only at the major three airports, as $1.00 per passenger-movement.

# ENDNOTES

1. VHB Research & Consulting, "Environmental Damage from Transportation," in Volume 4 of this report.

2. William A. Sims, "Externality Pricing," a report prepared for the Royal Commission on National Passenger Transportation, RR-07, Oct. 1991.

3. Government of Canada, *Economic Instruments for Environmental Protection.* Cat. No. En21-119/1992/E (Ottawa: Supply and Services Canada, 1992).

4. The following is drawn from the report by VHB Research & Consulting, "Environmental Damage," section 4.2, and from Transport Canada/Environment Canada, *A Plan to Identify and Assess Emission Reduction Opportunities from Transportation, Industrial Engines and Motor Fuels,* Report TP 9773 (Ottawa: Transport Canada, May 1989).

5. See C. Johnson, J. Henshaw and G. McInnes, "Impact of Aircraft and Surface Emissions of Nitrogen Oxides on Tropospheric Ozone and Global Warming," *Nature* 355 (Jan. 1992), pp. 69–71; and M. Barrett, *Aircraft Pollution, Environmental Impacts and Future Solutions,* World Wildlife Fund, Aug. 1991.

6. VHB Research & Consulting, "Environmental Damage," Table 4.

7. The estimate of pass-km per litre for ferries might be underestimated as fuel use is allocated between passenger and freight traffic according to deck space used, with no allowance for any effect of vehicle loads on fuel consumption. If weight were the only determinant, passengers and their vehicles would be responsible for much less fuel use, and the estimate of pass-km per litre in the table might rise by 50% or so. Information on vehicle loads is not available, but it is believed that they are of only minor additional importance to fuel consumption once use of deck space is allowed for.

8. This section is drawn particularly from VHB Research & Consulting, "Environmental Damage," Section 4.2.5.

9. For definitions of NAAQOs see Environment Canada, Inventory Management Division, Conservation and Protection, *National Urban Air Quality Trends 1978-1987,* Report EPS 7/UP/3 (Ottawa, May 1990), p. 6.

10. Ibid., Sections 4, 3 and 6.

11. Ibid., Section 5.

12. A summary of health effects is contained in D. V. Bates, "Adverse Health Effects of Automobile Emissions," unpublished paper presented to the Royal Commission on National Passenger Transportation Technical Seminar on Transportation and the Environment, Sept. 1991.

13. VHB Research & Consulting, "Environmental Damage."

14. Ontario Ministry of the Environment, *Ozone Effects on Crops in Ontario and Related Monetary Values,* Report ARB-13-84 (Toronto, 1984).

15. Transport Canada/Environment Canada, *A Plan to Identify,* p. 10.

16. Intergovernmental Panel on Climate Change, *Policy Makers Summary of the Scientific Assessment of Climate Change: Report to the IPCC from Working Group I*, United Nations Environment Programme, June 1990.

17. Predictions excerpted from Canadian Council of Ministers of the Environment (CCME), *National Action Strategy on Global Warming*, Nov. 1990, p. 4.

18. U.S. National Academy of Sciences, National Academy of Engineering, Institute of Medicine, *Policy Implications of Greenhouse Warming* (Washington, D.C.: National Academy Press, 1991).

19. W. D. Nordhaus, "To Slow or Not to Slow: The Economics of the Greenhouse Effect," (New Haven, CT: Yale University, Feb. 1990) (mimeograph); or see W. D. Nordhaus, "A Sketch of the Economics of the Greenhouse Effect," *American Economic Review Papers and Proceedings of the 103rd Annual Meeting*, May 1991, pp. 146-150.

20. See Transport Canada/Environment Canada, *A Plan to Identify*, for descriptions of proposals.

21. CCME, *Management Plan for Nitrogen Oxides (NO$_x$ and Volatile Organic Compounds (VOCs), Phase I*, CCME-EPC/TRE-31E, Nov. 1990.

22. Ibid., Appendix A.

23. Ibid., Table 20, p. 153.

24. Ibid., pp. 148–52.

25. The following notes rely heavily on CCME, *National Action Strategy on Global Warming*.

26. National Energy Board, *Canadian Energy Supply and Demand 1990–2010*, Cat. No. NE23-15/1991 (Ottawa: Supply and Services Canada, 1991).

27. United Nations, *Framework Convention on Climate Change* (New York, N.Y.: UN, May 1992).

28. Environment Canada, *Canada's Green Plan for a Healthy Environment*, Cat. No. En21-94/1990 (Ottawa: Supply and Services Canada, 1990).

29. See P. Reilly-Roe, "Assessment of Transportation Energy Technologies to 2020," Transportation Energy Division, Energy, Mines and Resources Canada, 1991 (unpublished mimeograph); and V. C. Battista, D. Boucher and E. R. Welbourne, "A Preliminary Review of Options for Reducing Emissions of Carbon Dioxide from Motor Vehicles," Technical Memorandum TMVS 9101, unpublished, Road Safety Directorate, Transport Canada, Jan. 1991.

30. Battista et al., "A Preliminary Review," pp. 34–40. The report suggests methanol from biomass would have essentially no net CO$_2$ emissions as it would initially fix atmospheric CO$_2$ and subsequently release it.

31. See R. F. Webb, "Alternative Fuels: Prospects and Effects," unpublished paper presented to the Royal Commission on National Passenger Transportation Technical Seminar on Transportation and the Environment, Sept. 1991.

32. We note that some U.S. states, starting with California, intend to require that manufacturers begin to supply vehicles with very low emissions (which initially means electric vehicles) within this decade.

33. CCME, *National Action Strategy on Global Warming.*

34. U.S. National Academy of Sciences, *Policy Implications*; and *Policy Implications of Greenhouse Warming, Report of the Mitigation Panel* (Washington, D.C.: National Academy Press, 1991).

35. The report's suggestion that consumers are uninformed or irrational in failing to adopt such cost-reducing technologies as compact fluorescent lightbulbs is challenged in W. D. Montgomery, *The Cost of Controlling Carbon Dioxide Emissions, Final Report*, Report CRA 858.00 (Washington, D.C.: Charles River Associates Incorporated, Dec. 1991). Montgomery suggests the alternative interpretation that consumers' rejection of such technology demonstrates that the NAS analysis understates the private costs or overstates the private benefits.

36. See for example, Environment Canada, *Economic Instruments for Environmental Protection*; Organisation for Economic Co-operation and Development (OECD), *Economic Instruments for Environmental Protection* (Paris: OECD, 1989); and more generally W. J. Baumol and W. E. Oates, *The Theory of Environmental Policy*, 2nd ed. (Cambridge, U.K.: Cambridge University Press, 1988).

37. CCME, *National Action Strategy on Global Warming*, section 8.2.1.

38. Environment Canada: *Canada's Green Plan*, pp. 156–8.

39. CCME, Emission Trading Working Group, *Emission Trading, A Discussion Paper*, CCME, May 1992.

40. For a detailed discussion see Sims, "Externality Pricing."

41. Strictly prices would need to be equal everywhere to social marginal cost.

42. Environment Canada, *Economic Instruments for Environmental Protection.*

43. See in particular: D. W. Pearce and A. Markyanda, *Environmental Policy Benefits: Monetary Valuation* (Paris: OECD, 1989); D. W. Pearce and R. K. Turner, *Economics of Natural Resources and the Environment* (Baltimore, MD: Johns Hopkins University Press, 1990); and VHB Research & Consulting, *Environmental Damage*, Sections 3.3 and 7.

44. OECD, *Economic Instruments*, Chapters 3 and 4.

45. See for example, D. W. Gillen and T. J. Levesque, *The Management of Airport Noise*, Report TP 10118 (Ottawa: Transport Canada, Transportation Development Centre, July 1990); and D. W. Gillen and T. J. Levesque, "Measuring the Noise Costs of Alternative Runway Expansion at LBPIA Using Residential Housing Markets," report prepared for Transport Canada, Major Crown Projects, Apr. 1991.

46. See J. A. Edmunds and J. M. Reilly, "Global Energy and $CO_2$ to the Year 2050," *The Energy Journal* 4 (1983), pp. 21–47; A. S. Manne and R. G. Richels, "Global $CO_2$ Emission Reductions: The Impact of Rising Energy Costs," *The Energy Journal* 12, 1 (1991), pp. 87–107; W. D. Nordhaus, "The Cost of Slowing Climate Change: a Survey," *The Energy Journal* 12, 1 (1991), pp. 37–65; D. W. Jorgensen and P. J. Wilcoxen, "The Cost of Controlling U.S. Carbon Dioxide Emissions," in *Proceedings of the Workshop on Economic/Energy/Environmental Modelling for Climate Policy Analysis*, eds. D. O. Wood and Y. Kaya (Cambridge, Mass.: MIT Center for Energy Policy Research, Jan. 1991); and U.S. Congressional Budget Office, *Carbon Charges as a Response to Global Warming: The Effects of Taxing Fossil Fuels* (Washington, D.C.: CBO, August 1990). For summaries and interpretations, see W. R. Cline, "Economic Models of Carbon Reduction Costs: An Analytical Survey," Harvard University Institute for International Economics, June 1991 (mimeograph); and Montgomery, *The Cost of Controlling*.

47. See M. Grubb, *The Greenhouse Effect: Negotiating Targets* (London, U.K.: Royal Institute of International Affairs, 1989).

48. Montgomery, *The Cost of Controlling*.

49. L. Hansson, "Air Pollution Fees and Taxes in Sweden," paper presented to 70th Annual Meeting of the Transportation Research Board, Washington, D.C., Jan. 1991.

50. J. J. Lawson, *Analysis of the Effects of Proposed Revisions to Light Motor Vehicle Emission Standards*, Report TP 6684 (Ottawa: Transport Canada, Road Safety Directorate, June 1985).

51. See T. H. Tietenberg, *Emissions Trading: An Exercise in Reforming Pollution Policy* (Washington, D.C.: Resources for the Future Inc., 1985); and discussions in Sims, "Externality Pricing"; Environment Canada, *Economic Instruments for Environmental Protection*; and A. J. Krupnick, "Vehicle Emissions, Urban Air Quality, and Clean Air Policy," discussion paper QE91-15 (Washington, D.C.: Resources for the Future, July 1991).

52. See Lawson, *Analysis of the Effects* and other comparisons of cost-effectiveness of control options in Krupnick, "Vehicle Emissions."

53. As proposed in B. K. Stevens, "A Tradeable Vehicle and Fuel Credits Program," paper presented to the (U.S.) Western Economic Association International Conference, 1991.

54. CCME, *Management Plan for Nitrogen Oxides and Volatile Organic Compounds, Phase I*, Tables 24 and 25, pp. 168–9.

55. Krupnick, "Vehicle Emissions," Table 2, p. 20.

56. Oral presentation by Lars Hansson, "Political problems of implementing emission and congestion pricing in Sweden," Session 198, Transportation Research Board 71st Annual Meeting, Washington, D.C., Jan. 1992.

57. From information provided to the Commission by Mr. T. Dann, Head Air Toxics Section, Technology Development Branch, Conservation and Protection, Environment Canada, Ottawa, dated May 25, 1992. Average "total station episode-days" by month during 1987-1989 were as follows (where an episode is one or more hours with ozone concentration greater than 81 ppb):

| Month | Episode-Days |
|---|---|
| April | 6 |
| May | 103 |
| June | 222 |
| July | 311 |
| August | 166 |
| September | 32 |
| October | 10 |

58. R. W. Lake et al., *Alternative to Air: A Feasible Concept for the Toronto–Ottawa–Montreal Corridor* (Kingston: Queen's University, CIGGT, 1980).

59. It can also be deduced from the report that reaching peak speed of 300 km/h rather than 260 km/h, a 15% increase in speed, requires 25% more energy.

60. A. M. Khan, *Energy and Environmental Factors in Intercity Passenger Transportation*, Report TP 10198 (Ottawa: Economic Analysis Division, Transport Canada, 1990).

61. L. R. Johnson et al., *Maglev Vehicles and Superconductor Technology: Integration of High-Speed Ground Transportation into the Air Travel System*, Argonne National Laboratory Report ANL/CNSV-67, Apr. 1989.

62. Dessau Inc., *A Review of the Environmental Impact of Investment in High-Speed Rail in the Ontario-Quebec Corridor: Final Report*, Ontario/Quebec Rapid Train Task Force (Aug. 1990).

63. This report also provides a range of estimates of energy use for a 200km/h service (British Rail HST, Amtrak Turboliner, or PCH Turboliner), of 220 kJ/pass-km to 400 kJ/pass-km.

64. See Ontario Hydro, *Submission to the National Energy Board, in the matter of an application by Ontario Hydro for export permits pursuant to Division II of the Act, Volume 4, Social Cost Studies* (Toronto: Ontario Hydro, Oct. 1990).

65. Some further support for this estimate is provided by T. Lynch, "Maglev and High Speed Rail System Environmental Energy and Economic Benefit Evaluation in Florida: A Comparative Analysis," in *Magnetic Levitation Technology and Transportation Strategies*, Report SP-834 (Warrendale, P.A.: Society of Automotive Engineers, Aug. 1990). This suggested the TGV-type train would use about 250 kJ/pass-km in "net" energy, or 750 kJ/pass-km in "gross" energy from thermal stations.

66. From A. P. Jaques, *National Inventory of Sources and Emissions of Carbon Dioxide (1987)*, Report EPS 5/AP/2 (Ottawa: Environment Canada, 1987), Table S.3. This average might understate average emissions from coal plants, as lignite is used to some extent in Ontario generating plants, with a $CO_2$ emission rate of 108.4 g/MJ.

67. Ontario Hydro, *Submission to*, Table 3.3, p. 3-27.

68. VHB Research & Consulting Inc., "Environmental Damage," Table 17, p. 55.

69. R. L. Ottinger, D. R. Wooley, N. A. Robinson, D. R. Hodas and S. E. Babb, *Environmental Costs of Electricity* (New York, NY: Oceana Publications, Inc., 1990).

70. Gillen and Levesque, *The Management*, see especially Tables 6-3 and 6-4, p. 188.

# NOTES TO CHAPTER 8: TRANSPORTATION SAFETY — ESTIMATION OF ACCIDENT RISKS AND COSTS

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# INTRODUCTION

The issues of transport safety were considered by the research staff of the Royal Commission, rather than through contracted research. The following notes are therefore more detailed than those supported by reports from contracted research.

## 1. SUMMARY OF TRANSPORT SAFETY

The history of transport safety shows that deaths, injuries and property damage have increased as traffic has grown. For example, there were 521 deaths in rail and road transport in 1921 and 4,060 deaths in 1990, while injuries and property damage increased faster still. The increase in accidents and casualties[1] over the long term, however, has been much less than the increase in traffic. The number of road fatalities grew quickly in the early days of motorization, but since 1930 it has only tripled, while the number of vehicles has increased 14-fold. It can be concluded that the "risks"[2] of accidents and casualties per vehicle-kilometre and per passenger-kilometre (pass-km) have fallen substantially. Recently, the improvement has been even more impressive. Since 1973, risks of death and serious injury have fallen faster than traffic has grown, so that the numbers of persons killed or seriously injured annually have fallen.

Within those transportation totals, it appears that risks have continued to decrease in passenger aviation and in trucking since deregulation. To the extent that deregulation has caused an increase in the use of smaller aircraft, some elevation of risks might be expected, but the reduction in risks from diverting traffic from road to air is likely to be much larger. In trucking, both the increase in truck traffic stimulated by deregulation and traffic diversion from rail are likely to increase truck accidents and the risks to other road users from trucks. There has been a strong downward trend in road accident risks, however, and improvements in vehicle and road technology, and in driver behaviour suggest that this will continue.

## 1.1 RELATIVE RISKS IN THE PASSENGER MODES

Table 8(2)-1 (which repeats Table 8-9 from Volume 1 of this report), provides two main safety indicators for comparisons among the passenger transportation modes. The first is the total numbers of persons killed in passenger operations — whether passengers, crew or bystanders — per billion pass-km. This indicator is referred to in Volume 1 as the "fatality rate in passenger operations." The importance of this indicator emerges when considering major changes in the extent of those operations, or major shifts among the modes, as it indicates how the total number of transportation-related deaths might change. The second indicator is the number of passengers killed per billion pass-km, referred to in Volume 1 as the "passenger fatality rate." This is the main indicator of the relative safety of passengers using the different modes, and is therefore of most interest to the travelling public.

Table 8(2)-1 illustrates these two fatality rates for the ground transportation modes and for three groups of air carriers. The following discussion describes those rates and considers possible trends for each mode.

*Table 8(2)-1*

*FATALITY RATES[a] PER BILLION INTERCITY PASSENGER-KILOMETRE BY MODE*

| Mode | Passenger fatality rate[b] | Fatality rate in passenger operations[c] |
|---|---|---|
| Air — Level 1 carriers[d] | 0.05 | 0.05 |
| Air — Level 2 carriers[d] | 0.7 | 1.0 |
| Air — Level 3 to 6 carriers[d] | 14.0 | 28.0 |
| Train | 0.8 | 13.8 |
| Bus | 0.0–1.0 | 2.0 |
| Ferry | 0.2 | 0.5 |
| Car | 10.0 | 13.0 |

a. Based on the 1980s as a whole, or recent years in 1980s.

b. Includes only passengers killed.

c. Includes passengers, crew and bystanders killed during passenger operations.

d. Includes all Canadian-registed carrier opeartions, domestic and international.

The many qualifications to these estimates follow. Important among them are that the traffic estimates are very rough for road transport, and that while all estimates are recent, they are not necessarily current. (The aviation and rail estimates are averaged over the last decade, for example, while the bus estimates are derived from accidents over a more limited period.) More importantly, the estimates are system-wide averages, and the trips — particularly their lengths — differ substantially by mode.

Within each mode, it is probable that risks are lower for longer trips. This is certainly the case for air travel, in which the risk falls with increasing stage length because of the dominance of the risks of landing and take-off, and because longer trips tend to be made in more reliable aircraft. It is probably also the case with rail travel, because longer trips are usually made over better-quality track (fewer grade crossings, in particular), and with bus travel, because the roads used are likely to be of better quality (divided highways, for example). For private motor-vehicle travel, better-quality roads will also be used on longer trips and, perhaps more importantly, the trips are more likely to be made in daylight, by experienced and unimpaired drivers using larger vehicles.

The qualifications on these estimates are particularly important in considering the effects of traffic shifting from one mode to another. For example, Table 8(2)-1 shows that shifting traffic from private motor vehicles to aircraft could save nearly one fatality for each 75 million pass-km, or that shifting 1% of highway car traffic to airplanes could prevent 27 deaths.[3] The true effects would probably be much less spectacular because the length of the trips that shifted would probably have a lower fatality rate than the road average, but would probably sustain a higher fatality rate than the air average.[4]

# 2. SUMMARIES OF SAFETY BY MODE

Each of the modes is summarized here, focussing on passenger safety. Then, some aspects of heavy truck safety are considered, and finally a brief summary of developments in road safety is provided.

## 2.1 AVIATION SAFETY

Statistics on aviation accidents are available from the Transportation Safety Board, together with estimates of hours flown by type of operation. Statistics Canada provides estimates of pass-km for air carriers. The relevant figures and derived estimates of aviation risks for the years 1981 to 1990 are shown in Tables 8(2)-2 to 8(2)-8. Table 8(2)-3 shows that 1,176 people died in aviation accidents during the decade; approximately half in private-flying and half in commercial operations. Of 607 killed in commercial aviation, only 68 flew with Level 1 or 2 carriers; the remainder flew with smaller carriers.

Aviation accidents and fatalities are so rare that they vary substantially year to year, making estimation of accident rates per unit of traffic uncertain. Those rates may be calculated for each year per 100,000 flying hours, which is the industry measure common to all types of traffic. As shown in Tables 8(2)-4 and 8(2)-6, even the annual rate for total aviation fatalities fluctuates substantially, and annual rates for the separate types of traffic fluctuate more than this. For Level 1 and 2 carriers, the single accidents in 1983 and 1989 (Cincinnati and Dryden) changed the annual fatality rates dramatically. To compare these services with the other types of traffic, it is necessary to average the rates over the entire decade (or another long period). Table 8(2)-6 shows that between 1981 and 1990 the rate of fatalities per 100,000 hours for private aviation was more than double the rate for all commercial aviation. For Level 1 and 2 carriers combined, the fatality rate was only one fifth of that for other levels of carriers, and Level 1 carriers had about one twentieth of the fatality rate of Level 2 carriers.

Given that smaller aircraft have slower operating speeds, the disparity in the rates of fatalities per kilometre flown would appear even greater between private and commercial services, and within the commercial services, between levels of carrier. Unfortunately, kilometres flown are not available for private aviation.

The comparisons rates of fatalities per pass-km among the various types of carrier, and how these rates change over time are of particular interest to the Royal Commission. Published data do not distinguish passengers from other fatalities (such as crew and others), so the major indicator that can be calculated is the "fatality rate in passenger operations." Tables 8(2)-7 and 8(2)-8 offer the relevant data. Again, to smooth the annual fluctuations, comparison is best made over the entire decade. Over the decade, Level 1 carriers provided about 95% of all pass-km by commercial carriers, with a fatality rate of 0.048 per billion pass-km, in other words, only one death every 20 billion pass-km. For Level 2 carriers, the rate was 1.0 fatality per billion pass-km (heavily influenced by the single Dryden crash), while for other levels of carriers the rate was as high as 28 deaths per billion pass-km, but their share was only 3.5% of all commercial pass-km.[5] For Levels 1 and 2 combined (the two national carriers, main feeders and charter operators), the fatality rate was 0.13 deaths per billion pass-km, one death every 7.7 billion pass-km.

Within those broader rates of fatalities in passenger operations, the passenger fatality rate can be distinguished using unpublished information provided by the Transportation Safety Board, which separates deaths of passengers from those of crew and others.[6] Figures obtained are aggregated over the decade 1981 to 1990, and show the following:

| **Class of carrier** | **Deaths of passengers** | **Deaths of others** |
|---|---|---|
| Level 1 | 23 | 0 |
| Level 2 | 34 | 11 |
| Levels 3 to 6 | 270 | 269 |
| All | 327 | 280 |

## AVIATION SAFETY INDICATORS, 1981 TO 1990

### Table 8(2)-2
### AVIATION OPERATING HOURS

| Year | Hours of operation in year (thousands) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 661 | 147 | 1,853 | 2,662 | 1,332 | 126 | 4,119 |
| 1982 | 621 | 110 | 1,612 | 2,343 | 1,212 | 133 | 3,689 |
| 1983 | 588 | 111 | 1,474 | 2,173 | 1,150 | 124 | 3,447 |
| 1984 | 611 | 114 | 1,452 | 2,176 | 1,027 | 119 | 3,322 |
| 1985 | 660 | 154 | 1,390 | 2,204 | 934 | 118 | 3,256 |
| 1986 | 690 | 172 | 1,441 | 2,303 | 764 | 105 | 3,173 |
| 1987 | 705 | 182 | 1,533 | 2,421 | 800 | 100 | 3,321 |
| 1988 | 759 | 384 | 1,456 | 2,600 | 800 | 100 | 3,500 |
| 1989 | 677 | 405 | 1,618 | 2,700 | 800 | 100 | 3,600 |
| 1990 | 690 | 641 | 1,369 | 2,700 | 800 | 100 | 3,600 |
| All | 6,662 | 2,421 | 15,199 | 24,282 | 9,619 | 1,126 | 35,027 |

**Sources: Canadian Aviation Safety Board and Transportation Safety Board.**

### Table 8(2)-3
### AVIATION FATALITIES

| Year | Number of fatalities in year | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 0 | 6 | 79 | 85 | 85 | 2 | 172 |
| 1982 | 0 | 0 | 73 | 73 | 49 | 1 | 123 |
| 1983 | 23 | 4 | 41 | 68 | 78 | 2 | 148 |
| 1984 | 0 | 0 | 62 | 62 | 58 | 0 | 120 |
| 1985 | 0 | 0 | 42 | 42 | 29 | 0 | 71 |
| 1986 | 0 | 0 | 48 | 48 | 61 | 4 | 113 |
| 1987 | 0 | 0 | 44 | 44 | 52 | 1 | 97 |
| 1988 | 0 | 4 | 50 | 54 | 40 | 1 | 95 |
| 1989 | 0 | 31 | 53 | 84 | 64 | 2 | 150 |
| 1990 | 0 | 0 | 47 | 47 | 40 | 0 | 87 |
| All | 23 | 45 | 539 | 607 | 556 | 13 | 1,176 |

**Sources: Canadian Aviation Safety Board and Transportation Safety Board.**

*Table 8(2)-4*

## AVIATION FATALITY RATES PER 100,000 OPERATING HOURS

| Year | Fatality rates per 100,000 hours | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 0.00 | 4.08 | 4.26 | 3.19 | 6.38 | 1.59 | 4.18 |
| 1982 | 0.00 | 0.00 | 4.53 | 3.12 | 4.04 | 0.75 | 3.33 |
| 1983 | 3.91 | 3.60 | 2.78 | 3.13 | 6.78 | 1.61 | 4.29 |
| 1984 | 0.00 | 0.00 | 4.27 | 2.85 | 5.65 | 0.00 | 3.61 |
| 1985 | 0.00 | 0.00 | 3.02 | 1.91 | 3.10 | 0.00 | 2.18 |
| 1986 | 0.00 | 0.00 | 3.33 | 2.08 | 7.98 | 3.80 | 3.56 |
| 1987 | 0.00 | 0.00 | 2.87 | 1.82 | 6.50 | 1.00 | 2.92 |
| 1988 | 0.00 | 1.04 | 3.43 | 2.08 | 5.00 | 1.00 | 2.71 |
| 1989 | 0.00 | 7.65 | 3.28 | 3.11 | 8.00 | 2.00 | 4.17 |
| 1990 | 0.00 | 0.00 | 3.43 | 1.74 | 5.00 | 0.00 | 2.42 |
| All | 0.35 | 1.86 | 3.55 | 2.50 | 5.78 | 1.15 | 3.36 |

**Source:** Calculated from data in Tables 8(2)-2 and 8(2)-3.

*Table 8(2)-5*

## AVIATION FATAL ACCIDENTS

| Year | Number of fatal accidents in year | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 0 | 1 | 39 | 40 | 47 | 1 | 88 |
| 1982 | 0 | 0 | 32 | 32 | 29 | 1 | 62 |
| 1983 | 1 | 1 | 17 | 19 | 43 | 1 | 63 |
| 1984 | 0 | 0 | 27 | 27 | 31 | 0 | 58 |
| 1985 | 0 | 0 | 18 | 18 | 22 | 0 | 40 |
| 1986 | 0 | 0 | 29 | 29 | 35 | 1 | 65 |
| 1987 | 0 | 0 | 23 | 23 | 29 | 1 | 53 |
| 1988 | 0 | 2 | 23 | 25 | 24 | 1 | 50 |
| 1989 | 0 | 3 | 21 | 24 | 34 | 1 | 59 |
| 1990 | 0 | 0 | 22 | 22 | 24 | 0 | 46 |
| All | 1 | 7 | 251 | 259 | 318 | 7 | 584 |

**Source:** Canadian Aviation Safety Board and Transportation Safety Board.

*Table 8(2)-6*

## AVIATION FATAL ACCIDENT RATES PER 100,000 OPERATING HOURS

| Year | Fatal accident rates per 100,000 hours | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 0.000 | 0.679 | 2.104 | 1.503 | 3.529 | 0.794 | 2.136 |
| 1982 | 0.000 | 0.000 | 1.985 | 1.366 | 2.392 | 0.751 | 1.681 |
| 1983 | 0.170 | 0.900 | 1.153 | 0.874 | 3.739 | 0.806 | 1.828 |
| 1984 | 0.000 | 0.000 | 1.859 | 1.241 | 3.018 | 0.000 | 1.746 |
| 1985 | 0.000 | 0.000 | 1.295 | 0.817 | 2.355 | 0.000 | 1.228 |
| 1986 | 0.000 | 0.000 | 2.013 | 1.259 | 4.580 | 0.949 | 2.049 |
| 1987 | 0.000 | 0.000 | 1.500 | 0.950 | 3.625 | 1.000 | 1.596 |
| 1988 | 0.000 | 0.521 | 1.579 | 0.962 | 3.000 | 1.000 | 1.429 |
| 1989 | 0.000 | 0.741 | 1.298 | 0.889 | 4.250 | 1.000 | 1.639 |
| 1990 | 0.000 | 0.000 | 1.607 | 0.815 | 3.000 | 0.000 | 1.278 |
| All | 0.015 | 0.289 | 1.651 | 1.067 | 3.306 | 0.622 | 1.667 |

**Source:** **Calculated from data in Tables 8(2)-2 and 8(2)-5.**

*Table 8(2)-7*

## AVIATION PASSENGER-KILOMETRES

| Year | Pass-km in year (millions) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Level 1 carriers | Level 2 carriers | Other carriers | All commercial | Private | Govt. | Total |
| 1981 | 45,300 | 395 | 383 | 46,078 | not available | not available | not applicable |
| 1982 | 42,855 | 597 | 750 | 44,202 | | | |
| 1983 | 41,895 | 737 | 783 | 43,415 | | | |
| 1984 | 44,690 | 1,262 | 904 | 46,856 | | | |
| 1985 | 47,181 | 1,819 | 967 | 49,967 | | | |
| 1986 | 47,788 | 2,779 | 2,517 | 53,084 | | | |
| 1987 | 48,266 | 4,787 | 2,311 | 55,364 | | | |
| 1988 | 54,121 | 7,491 | 2,248 | 63,860 | | | |
| 1989 | 53,049 | 10,115 | 4,961 | 68,125 | | | |
| 1990 | 50,125 | 15,883 | 3,393 | 69,401 | | | |
| All | 475,270 | 45,865 | 19,217 | 540,352 | | | |

**Sources:** **For unit toll services: Statistics Canada, *Aviation in Canada*, Catalogue No. 51-501, Dec. 1986, and *Canadian Civil Aviation*, Catalogue No. 51-206. For charter services: private communication from Statistics Canada, Aviation Statistics Centre.**

*Table 8(2)-8*

*AVIATION FATALITY RATES PER BILLION PASSENGER-KILOMETRES*

| **Year** | **Fatalities per billion pass-km** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Level 1 carriers** | **Level 2 carriers** | **Other carriers** | **All commercial** | **Private** | **Govt.** | **Total** |
| 1981 | 0.000 | 15.190 | 206.266 | 1.845 | not available | not available | not applicable |
| 1982 | 0.000 | 0.000 | 97.333 | 1.652 | | | |
| 1983 | 0.549 | 5.427 | 52.363 | 1.566 | | | |
| 1984 | 0.000 | 0.000 | 68.584 | 1.323 | | | |
| 1985 | 0.000 | 0.000 | 43.433 | 0.841 | | | |
| 1986 | 0.000 | 0.000 | 19.070 | 0.904 | | | |
| 1987 | 0.000 | 0.000 | 19.039 | 0.795 | | | |
| 1988 | 0.000 | 0.534 | 22.242 | 0.846 | | | |
| 1989 | 0.000 | 3.065 | 10.683 | 1.233 | | | |
| 1990 | 0.000 | 0.000 | 13.852 | 0.677 | | | |
| All | 0.048 | 0.981 | 28.048 | 1.123 | | | |

**Source: Calculated from data in Tables 8(2)-3 and 8(2)-7.**

Dividing these figures by the pass-km travelled by carriers of each level (given in Table 8(2)-7) results in passanger fatality rates per billion pass-km as follows:

| **Class of carrier** | **Fatalities per billion pass-km** |
|---|---|
| Level 1 | 0.048 |
| Level 2 | 0.741 |
| Levels 3 to 6 | 14.050 |
| All levels | 0.605 |

While these rates represent the decade's experience, it must be emphasized that the rates for Level 1 and 2 carriers are the result of an extremely small number of crashes, and may change radically in a short period due to the large numbers of passengers potentially involved in single events. At the time of writing, it is known that a single crash of a Level 2 carrier's aircraft in 1991 has changed the 10-year average radically.[7] This event has not been included in the intermodal comparisons in the Royal Commission's report, in consequence of a decision to standardize information by using the most recent decade (1981 to 1990) for which data are currently available in most of the modes.

### 2.1.1 How is Passenger Aviation Safety Changing over Time?

From the information in Tables 8(2)-2 to 8(2)-8, it appears that the fatal accident rates and fatality rates per pass-km for all commercial operations have improved over the decade. Examining the rates by level of carrier, however, shows that the trend was determined essentially by the experience of the smaller carriers. The infrequency of crashes among Level 1 and 2 carriers makes it impossible to determine whether their safety has improved over the period, or to make a confident estimate of the expected fatality rates for those carriers in the immediate future.

For greater confidence, we can look to safety experience in the United States, which has similar aircraft and operating conditions, but much larger numbers of operations and pass-km. We have no reason to believe Canadian carriers have worse safety records than their U.S. counterparts (and some evidence that Canadian safety records are better). In the United States, we can see a 30-year trend of reductions in accidents and fatalities per billion pass-km.[8]

### 2.1.2 What Has Been the Effect of Airline Deregulation on Safety?

The effect of Canadian deregulation in stimulating Level 1 and 2 carriers' traffic can be seen in Tables 8(2)-2 and 8(2)-7. No effect on aviation fatalities can be discerned, because of the uncertainty in estimating fatality rates in the short term. The hypothesis that deregulation would reduce profitability and lead to cuts in safety was tested to some extent in a recent Canadian study.[9] While the study found some intriguing evidence that spending by carriers on maintenance is associated with lower rates of accidents (broadly defined), it found no relationship between the profitability of carriers and their overall accident experience.

We can turn again to the United States, which has much larger numbers of flights and pass-km, for evidence of the safety effect of deregulation. Several experts have concluded that U.S. deregulation has not led to a degradation of safety.[10] Since deregulation in 1978, accident rates have followed the downward trend established in the regulated period. Moore shows that, during the period 1979 to 1986, total air carrier accidents, fatal accidents and fatalities all declined by over 40% compared with the period 1971 to 1978, and the rates per flight hour declined even more.[11] Oster and Zorn compare the period 1979 to 1985 with 1970 to 1978, and conclude that for all U.S. domestic scheduled services, fatal accidents per million aircraft departures more than halved from 0.46 to 0.22, while passenger fatalities per million passenger enplanements fell from 0.42 to 0.30.[12]

There had been concern that deregulation would switch traffic from major carriers to commuter carriers, and that the latter had worse safety records. Comparing the same periods, however, showed only slightly greater growth in flight hours for air taxis and commuter airlines than for scheduled large jet air carriers (29.8% versus 26.1%).[13] More importantly, passenger safety was shown to improve more for smaller carriers than for larger carriers. Oster and Zorn show that on domestic scheduled services, fatalities per million passengers remained essentially unchanged among trunk carriers, and also among the 20 largest commuter carriers, but fell by over 60% among the smaller commuter carriers.[14] They explain that much of the reduction resulted from a change in average stage length among the commuter carriers. The records of commuter carriers per pass-km reflect their shorter average stage lengths, and the fact that rates of accidents and deaths fall with increased stage length because the risks are much lower when cruising compared with landing or taking off. (This also partially explains the apparently higher fatality rates of Canadian Level 2 carriers compared with Level 1, and of Levels 3–6 carriers compared with Level 2.) The switch to commuter lines following deregulation was part of the hub-and-spoke development, which actually reduced the number of stops on a typical passenger's flight, thereby substantially improving the commuter carriers' safety.[15]

Overall, researchers reach the cautious conclusion that, although the increase in commuter traffic possibly raised average risks per pass-km compared with what might have occurred without deregulation, air safety continued to improve.

Furthermore, commentators note that, to the extent that aviation deregulation diverted traffic from road to air travel, the safety of that traffic improved substantially (see notes on road passenger risks). A study by Bylow and Savage uses a model of highway travel demand to estimate the reduction in road travel as a result of airline deregulation, and then uses U.S. rural highway fatality rates per vehicle-kilometre to estimate the reduction in highway deaths. The authors suggest that highway deaths were reduced by 3,000 over the period 1978 to 1988, dwarfing estimates of the effects of deregulation in raising the risk of air fatalities.[16]

## 2.2 RAIL SAFETY

Major indicators of rail safety are provided in Tables 8(2)-9 to 8(2)-12. Table 8(2)-9 first shows deaths arising from all rail operations, most of which transport freight, of course. Over the decade to 1990, there was a total of 1,255 deaths. Half occurred in grade crossing accidents, and nearly all were occupants of the motor vehicles struck. Another 40% were persons struck by trains, either employees, or persons walking on tracks, including suicides. Only 54 deaths (less than 5% of the total) came from collisions or derailments, and 24 of these occurred in a single crash in 1986 at Hinton, Alberta.

The annual total of fatalities declined fairly steadily through the decade. Table 8(2)-10 shows that train-kilometres also declined, but less than fatalities, so the overall fatality rate per train-kilometre declined slightly over the period. Among the accident types, deaths in collisions and derailments are so rare that annual rates per train-kilometre are too unstable to show trends. Little change over time can be discerned in the death rate of persons struck by trains, but some improvement does seem to have occurred in the rate of deaths from grade crossing accidents.

*Table 8(2)-9*

## FATALITIES IN RAIL ACCIDENTS, 1981 TO 1990

| Year | Fatalities by type of incident | | | | | |
|---|---|---|---|---|---|---|
| | Main-track collisions/ derailments | Other collisions/ derailments | Grade crossing accidents | Persons struck on track | Other | Total |
| 1981 | 3 | 2 | 82 | 62 | 4 | 153 |
| 1982 | 0 | 4 | 77 | 57 | 7 | 145 |
| 1983 | 6 | 2 | 60 | 52 | 6 | 126 |
| 1984 | 1 | 0 | 70 | 51 | 2 | 124 |
| 1985 | 0 | 4 | 58 | 61 | 5 | 128 |
| 1986 | 24 | 0 | 47 | 44 | 3 | 118 |
| 1987 | 0 | 1 | 50 | 53 | 2 | 106 |
| 1988 | 2 | 0 | 58 | 49 | 2 | 111 |
| 1989 | 0 | 5 | 85 | 49 | 2 | 141 |
| 1990 | 0 | 0 | 47 | 53 | 3 | 103 |
| All | 36 | 18 | 634 | 531 | 36 | 1,255 |

**Source: Transportation Safety Board.**

*Table 8(2)-10*

## FATALITY RATES IN RAIL ACCIDENTS, 1981 TO 1990

| Year | Train-km (m) | Fatalities per million train-km by type of incident | | | | | |
|---|---|---|---|---|---|---|---|
| | | Main-track collisions/ derail-ments | Other collisions/ derail-ments | Grade crossing accidents | Persons struck on track | Other | Total |
| 1981 | 131.9 | 0.023 | 0.015 | 0.622 | 0.470 | 0.030 | 1.160 |
| 1982 | 113.3 | 0.000 | 0.035 | 0.680 | 0.503 | 0.062 | 1.280 |
| 1983 | 116.8 | 0.051 | 0.017 | 0.514 | 0.445 | 0.051 | 1.079 |
| 1984 | 124.5 | 0.008 | 0.000 | 0.562 | 0.410 | 0.016 | 0.996 |
| 1985 | 121.3 | 0.000 | 0.033 | 0.478 | 0.503 | 0.041 | 1.055 |
| 1986 | 120.8 | 0.199 | 0.000 | 0.389 | 0.364 | 0.025 | 0.977 |
| 1987 | 122.8 | 0.000 | 0.008 | 0.407 | 0.432 | 0.016 | 0.863 |
| 1988 | 125.7 | 0.016 | 0.000 | 0.462 | 0.390 | 0.016 | 0.883 |
| 1989 | 119.9 | 0.000 | 0.042 | 0.709 | 0.409 | 0.017 | 1.176 |
| 1990 | 112.8 | 0.000 | 0.000 | 0.417 | 0.470 | 0.027 | 0.913 |
| All | 1,209.8 | 0.030 | 0.015 | 0.524 | 0.439 | 0.030 | 1.037 |

**Sources: Train-kilometres from Transportation Safety Board; fatality rates computed by Royal Commission staff from train-kilometres plus data in Table 8(2)-9.**

## Table 8(2)-11

## FATALITIES IN RAIL PASSENGER OPERATIONS, 1981 TO 1990

| Year | Fatalities by type of victim | | | | |
|---|---|---|---|---|---|
| | Passengers | Crew | Victims at crossings | Trespassers | Total |
| 1981 | 0 | 0 | 17 | 14 | 31 |
| 1982 | 0 | 0 | 17 | 14 | 31 |
| 1983 | 4 | 1 | 10 | 17 | 32 |
| 1984 | 0 | 0 | 21 | 9 | 30 |
| 1985 | 0 | 0 | 21 | 16 | 37 |
| 1986 | 16 | 7 | 18 | 16 | 57 |
| 1987 | 0 | 0 | 12 | 11 | 23 |
| 1988 | 0 | 0 | 12 | 7 | 19 |
| 1989 | 0 | 0 | 27 | 15 | 42 |
| 1990 | 0 | 0 | 19 | 14 | 33 |
| All | 20 | 8 | 174 | 133 | 335 |

**Source: Personal communication between Transportation Safety Board staff and Royal Commission staff.**

## Table 8(2)-12

## FATALITY RATES IN RAIL PASSENGER OPERATIONS, 1981 TO 1990

| Year | Intercity pass-km (millions) | Fatality rates per billion intercity pass-km | | | | |
|---|---|---|---|---|---|---|
| | | Passengers | Crew | Victims at crossings | Trespassers | Total |
| 1981 | 2,844 | 0.000 | 0.000 | 5.977 | 4.923 | 10.900 |
| 1982 | 2,267 | 0.000 | 0.000 | 7.499 | 6.176 | 13.674 |
| 1983 | 2,545 | 1.572 | 0.393 | 3.929 | 6.680 | 12.574 |
| 1984 | 2,515 | 0.000 | 0.000 | 8.350 | 3.579 | 11.928 |
| 1985 | 2,622 | 0.000 | 0.000 | 8.009 | 6.102 | 14.111 |
| 1986 | 2,390 | 6.695 | 2.929 | 7.531 | 6.695 | 23.849 |
| 1987 | 2,236 | 0.000 | 0.000 | 5.367 | 4.919 | 10.286 |
| 1988 | 2,418 | 0.000 | 0.000 | 4.963 | 2.895 | 7.858 |
| 1989 | 2,798 | 0.000 | 0.000 | 9.650 | 5.361 | 15.011 |
| 1990 | 1,473 | 0.000 | 0.000 | 12.895 | 9.501 | 22.396 |
| All | 24,108 | 0.830 | 0.332 | 7.217 | 5.517 | 13.896 |

**Sources: Intercity pass-km from Statistics Canada, *Railway Transport: Part IV, Operating and Traffic Statistics*, Catalogue No. 52-210, to 1981, and unpublished data thereafter, with interpolation for 1990 from VIA Rail annual report; fatality rates calculated by Royal Commission staff from pass-km plus data from Table 8(2)-11.**

The safety of passenger rail operations is portrayed in Tables 8(2)-11 and 8(2)-12 (provided by the Transportation Safety Board from unpublished tabulations). Passenger fatalities averaged about two per year, but there were no deaths in eight of the years, and 16 deaths in 1986 in the single crash at Hinton. Over the decade, passenger operations also resulted in eight crew deaths, 174 deaths at grade crossings, and the deaths of 133 trespassers.

Table 8(2)-12 shows that pass-km on intercity rail services fluctuated somewhat during much of the decade, but then dropped by nearly half in 1990, following the major cuts in VIA Rail services. The same Statistics Canada source shows that commuter pass-km rose over the period, comprising 13% of total pass-km in 1981, and 19% in 1988. The fatality rates in Table 8(2)-12 (and in Chapter 8 of Volume 1 of this report) are expressed relative to pass-km for intercity services, while the fatality estimates in Table 8(2)-11 include deaths occurring in commuter services. The fatality rates are therefore somewhat overstated. Table 8(2)-12 first shows the passenger fatality rate for the decade, averaging 0.83 deaths per billion intercity pass-km. It then shows fatality rates for each of the types of non-passenger, and finally totals the overall fatality rate in passenger operations, which averaged 13.9 over the period. It can be seen that the annual passenger fatality rate per pass-km is subject to major, erratic variation because of variability in the frequency of deaths, and therefore no trend can be recognized. The annual total fatality rate in passenger operations is less variable, but shows no trend over this relatively short period.

## 2.3 INTERCITY BUS SAFETY

Statistics describing the safety of intercity bus operations are very sparse. Provinces and territories are responsible for their own road accident reporting systems, and none routinely reports the total numbers of casualties cross-referenced to the types of vehicles involved in the accidents. Only five jurisdictions (Saskatchewan, Manitoba, Ontario, Nova Scotia and Newfoundland) have distinguished intercity buses from transit buses in their police report forms and computer systems. All jurisdictions recently agreed to report annually to the Canadian Council of Motor Transport Administrators the number of victims killed and injured in intercity buses as part of the effort to monitor the impact of deregulation and the National Safety Code. Their agreement, however, has not been implemented.

Table 8(2)-13 presents a special tabulation from Transport Canada's provincial and territorial computer files showing victims killed and injured in accidents involving intercity buses in the five provinces listed.[17] The table combines the numbers for the three years from 1985 to 1987, showing a total of seven deaths and 265 injuries in these accidents. Of these, no bus occupants were killed, and 27 bus drivers and 73 bus passengers were injured. All seven deaths, and 135 of the other 165 injured, were occupants of other vehicles, which were nearly all cars or light trucks. Only four of the bus occupants and 17 of the other victims were injured severely enough to require hospitalization.

*Table 8(2)-13*

*INTERCITY BUS ACCIDENT VICTIMS, FIVE PROVINCES,[a] 1985 TO 1987*

| Victim type | Severity of Injury[b] | | | |
|---|---|---|---|---|
| | Minimal | Minor | Major | Fatal |
| Bus driver | 16 | 10 | 1 | 0 |
| Bus passenger | 51 | 19 | 3 | 0 |
| Occupant of other vehicle | 74 | 47 | 14 | 7 |
| Motorcyclist | 2 | 3 | 0 | 0 |
| Bicyclist | 2 | 5 | 0 | 0 |
| Pedestrian | 5 | 10 | 3 | 0 |
| All | 150 | 94 | 21 | 7 |

**Source: Personal communication between staff of Transport Canada and Royal Commission staff.**

**a. Saskatchewan, Manitoba, Ontario, Nova Scotia and Newfoundland.**

**b. Minimal — no treatment required;**
**Minor — treated but not admitted to hospital;**
**Major — admitted to hospital.**

This tabulation can offer no indication of trends over time, and suggests that the annual numbers would be too small to allow trends to be recognized easily even if a long series were available. It is possible only to speculate about trends, but it is relevant that the majority of victims in these accidents were in cars and light trucks, and it is known that the accident rates and "crashworthiness" of those vehicles (the ability of occupants to survive crashes) have improved over time. Improvement will likely continue as accident avoidance capabilities are developed (for example, through anti-lock braking systems, hazard detection systems, and the vehicle guidance aspects of "intelligent vehicle-highway systems"), crashworthiness is improved (through air bags and enhanced side-impact protection) and seat belts are used more consistently.

No estimates of the death and injury rates per intercity bus vehicle-kilometre and pass-km can be made confidently from the information available, particularly as we have no estimates of pass-km travelled in the five provinces concerned. Making the very heroic assumption that the ratio of intercity bus casualties to total road casualties in these five provinces is the same in other jurisdictions, it is possible to estimate total casualties in intercity bus accidents for the three years from 1985 to 1987 as approximately 17 fatalities and 500 injured. Total national traffic in intercity bus services in 1991 is estimated by Royal Commission staff as 3.3 billion pass-km. If traffic was at that same level during 1985 to 1987, the total for the three years would have been 9.9 billion pass-km, and the average risk of fatalities in passenger operations for the period would therefore have been 1.7 deaths per billion pass-km. Due to the uncertainty in both the number of deaths and the traffic estimates, this fatality rate is rounded in Chapter 8 of Volume 1 of this report as 2.0 deaths per billion pass-km.

From the information available, none of the victims during these three years was a bus occupant, so the estimated bus passenger fatality risk would be zero — clearly incorrect as a representation of the long-term risk. To provide some indication of the likely risk, in order to make intermodal comparisons in Volume 1 of this report, it is guessed that passenger fatalities constitute less than half the total fatalities in bus operations. Noting that passengers constituted 73 of the total of 265 injured victims, the true bus passenger risk would lie somewhere between 0 and 1.0 deaths per billion pass-km.

## 2.4 FERRY SAFETY

Statistics from the Transportation Safety Board (unpublished tabulation) on passenger deaths on ferries are summarized in Table 8(2)-14. These relate to all ferries in Canada, not just the longer services on which the Royal Commission has focussed in Volume 1.[18] The table distinguishes the latter "intercity" ferries from those relating to "river or harbour crossings," showing that six passengers died on intercity ferries during the decade to 1990, of a total of 20 passenger deaths on all ferries.

*Table 8(2)-14*
*PASSENGER DEATHS IN ACCIDENTS ABOARD FERRIES*

| Year | Intercity ferries | River/harbour crossings | Total |
|---|---|---|---|
| 1981 | 1 | 3 | 4 |
| 1982 | 1 | 3 | 4 |
| 1983 | 0 | 1 | 1 |
| 1984 | 0 | 3 | 3 |
| 1985 | 1 | 1 | 2 |
| 1986 | 2 | 0 | 2 |
| 1987 | 0 | 0 | 0 |
| 1988 | 1 | 0 | 1 |
| 1989 | 0 | 0 | 0 |
| 1990 | 0 | 3 | 3 |
| All | 6 | 14 | 20 |

**Source: Personal communication between Transportation Safety Board staff and Royal Commission staff.**

Fatalities in ferry passenger operations should also include deaths of crew and any other non-passengers. Other unpublished statistics from the Transportation Safety Board show that there were a total of 26 deaths aboard or involving ferries during the decade.[19] From this it can be deduced that six of those who died were not passengers. The proportion of those non-passenger deaths occurring in the intercity services is not known, but, if similar to the proportion among passenger fatalities, would mean that two of the six were in intercity services. The total number of deaths in intercity passenger ferry operations during the decade is therefore estimated at eight.

To assess risks associated with ferry transport, these rough estimates of fatalities are converted to annual averages. Passenger fatalities amounted to about 0.6 per year during the decade, and total fatalities in passenger operations to about 0.8 per year. Passenger-kilometres are not available in traffic records for the whole decade, but have been estimated, in the Notes to Chapter 3 of this report, for all the intercity ferries, at about 830 million pass-km in 1990. Assuming that the average annual fatalities for the decade were constant,[20] estimated risks for passenger deaths are 0.7 deaths per billion pass-km, and for fatalities in passenger operations about 1.0 deaths per billion pass-km.

## 2.5 PRIVATE MOTOR-VEHICLE SAFETY IN INTERCITY TRAVEL

The aggregate risks associated with intercity passenger travel by private motor vehicles (cars, vans and light trucks) can be roughly estimated as follows. Transport Canada statistics of motor-vehicle traffic accidents provide the number of fatalities on roads with speed limits greater than 60 km/h — including highways and local rural roads. In 1989 there were 2,808 such fatalities, constituting 65% of total motor vehicle fatalities for the year.[21] The Royal Commission's estimate of total highway passenger-vehicle traffic for the year was 210 billion pass-km. Comparing the two gives a fatality rate of 13 per billion pass-km, or one fatality for every 80 million pass-km. In addition, we can estimate the rate of persons injured (of all severities) as 440 per billion pass-km.

The passenger fatality rate in road use is interpreted differently than in the public transport modes because there is no important distinction between private vehicle passengers and "crew." Private vehicle operators are nearly always travellers themselves (professional drivers being rare exceptions), and so should be included in the calculation of a passenger fatality rate. This rate differs considerably from the fatality rate in passenger operations, because private-vehicle occupants (drivers and other occupants) constitute about 80% of the total fatalities. The remainder are pedestrians, motorcyclists, bicyclists or occupants of vehicles of other types (heavy trucks, mobile equipment, and so on). In 1989 the passenger fatality rate was about 10 per billion pass-km.

## 2.6 HEAVY TRUCK SAFETY

As in the intercity bus case, information on truck safety has not been routinely available due to the failure of the provinces and territories to tabulate their records of accident victims by vehicle type. Limited information has become available recently as a result of the agreement through the Canadian Council of Motor Transport Administrators to monitor the effects of the National Safety Code. (This information provides the input to Transport Canada's annual report to Parliament on "Commercial Vehicle Safety in Canada," required under the *National Transportation Act, 1987*.) The information is limited particularly because it provides no details on the number of accident victims. Instead, it merely indicates the number of accidents of each severity in which heavy trucks were involved. These numbers are provided for the years 1986 to 1988 in Table 8(2)-15.

Traffic data comparable with the accident information in Table 8(2)-15 are not available. National compilations of the numbers of vehicles registered do not even distinguish heavy trucks from light trucks (that is, pickups and small vans, which probably outnumber heavy trucks by 10 times). No vehicle-kilometre information exists beyond that obtained for part of the heavy truck fleet from Statistics Canada's surveys of major carriers and partial surveys of private trucking. For some provinces, it is possible to estimate that heavy trucks account for about 3% of vehicles registered. By extrapolation, one can roughly estimate that they account for 9% of total vehicle-kilometres by road.[22] In contrast, the table shows that trucks were involved in slightly less than 3% of non-fatal injury accidents in each of the three years, but in about 9% of all fatal accidents. It seems likely that trucks are substantially under-involved in accidents relative to their vehicle-kilometres travelled — that is, they are less likely to crash per vehicle-kilometre than cars — but when accidents occur the greater weight of the trucks makes the consequences more severe.[23]

*Table 8(2)-15*
*HEAVY TRUCK INVOLVEMENTS IN ACCIDENTS, 1986 TO 1988*

| Fatal accidents | | | | | | |
|---|---|---|---|---|---|---|
| | Year 1986 | | Year 1987 | | Year 1988 | |
| **Vehicle type** | **Number** | **%** | **Number** | **%** | **Number** | **%** |
| Straight truck | 141 | 2.6 | 190 | 3.3 | 195 | 3.5 |
| Tractor-trailer | 319 | 5.8 | 344 | 5.9 | 327 | 5.8 |
| Pickup/van | 918 | 16.7 | 940 | 16.2 | 988 | 17.6 |
| Automobile | 3,200 | 58.3 | 3,581 | 61.6 | 3,497 | 62.2 |
| Other | 913 | 16.6 | 760 | 13.1 | 616 | 11.0 |
| **Total** | **5,491** | **100.0** | **5,815** | **100.0** | **5,623** | **100.0** |

| Injury accidents | | | | | | |
|---|---|---|---|---|---|---|
| | Year 1986 | | Year 1987 | | Year 1988 | |
| **Vehicle type** | **Number** | **%** | **Number** | **%** | **Number** | **%** |
| Straight truck | 4,848 | 1.5 | 4,886 | 1.4 | 5,461 | 1.6 |
| Tractor-trailer | 3,986 | 1.2 | 4,289 | 1.3 | 4,151 | 1.2 |
| Pickup/van | 38,780 | 12.0 | 42,044 | 12.3 | 43,624 | 13.0 |
| Automobile | 235,819 | 73.1 | 255,312 | 74.7 | 251,018 | 75.0 |
| Other | 39,163 | 12.1 | 35,473 | 10.4 | 30,597 | 9.1 |
| **Total** | **322,596** | **100.0** | **342,004** | **100.0** | **334,851** | **100.0** |

**Source: Personal communication between staff of Transport Canada and Royal Commission staff.**

Just how severe is shown in Table 8(2)-16, which compares injuries sustained by the truck occupants with those of the other victims in these accidents. From a large sample of heavy truck accidents analyzed by Transport Canada staff,[24] the table shows that a total of 90 truck occupants were killed and 4,078 injured. About half of these were single-vehicle accidents. Non-truck victims accounted for 392 deaths and 6,806 injuries. Sixty-seven of those killed were pedestrians, bicyclists or motorcyclists — the most vulnerable road users — and the other 324 were occupants of cars or light trucks. Accidents involving cars or light trucks illustrate the disproportion in risks faced by the light and heavy vehicle occupants: the accidents produced 27 times as many deaths in light vehicles as in heavy trucks (324:12), and 4.6 times as many injuries.

*Table 8(2)-16*

*HEAVY TRUCK OCCUPANT CASUALTIES (SAMPLE 1984 TO 1986)*

| Traffic unit | Victims in truck |  | Victims not in truck |  |
|---|---|---|---|---|
|  | **Killed** | **Injured** | **Killed** | **Injured** |
| Pedestrian | 0 | 0 | 40 | 188 |
| Bicycle | 0 | 0 | 11 | 79 |
| Motorcycle | 0 | 2 | 17 | 128 |
| Car/light truck | 12 | 1,380 | 324 | 6,411 |
| Straight truck | 10 | 349 | — | — |
| Tractor-trailer | 15 | 561 | — | — |
| No other unit | 53 | 1,786 | — | — |
| **Total** | **90** | **4,078** | **392** | **6,806** |

**Source:** **E.R. Welbourne and P. Gutoskie, "Heavy truck accidents, casualties and countermeasures,"** ***Proceedings of the Canadian Multidisciplinary Road Safety Conference VI*** **(Fredericton, N.B.: University of New Brunswick, 1989) pp. 183–93.**

### 2.6.1 Effects of Increasing Truck Sizes

Canada allows substantially larger and heavier trucks to use its highways routinely than does the United States, particularly since the signing of a Memorandum of Understanding among provinces and territories in September 1989.[25] This agreement followed extensive review of the issue of the safety of various trucks, and original work (by the National Research Council, through TAC) on the stability of heavy truck configurations. Evidence on the safety of different classes of truck from over-the-road experience is confounded by differences in operating conditions. Studies find lower accident involvement rates for combination trucks (various tractor and trailer configurations) than for the lighter and shorter straight trucks, and lower rates for double-trailer combinations than for single trailers.[26] It is clear that the larger, heavier trucks operate in more favourable conditions, in particular on major rural highways that have lower accident rates for all traffic, and probably operate with more experienced and capable drivers. Comparing trucks under similar conditions, the U.S. Transportation Research Board finds that the accident and fatality rates of trucks increase with gross weight and dimensions, but by much less than the carrying capacity.[27] This suggests that transferring loads to larger trucks, and therefore using fewer trucks for a given tonnage of freight, improves safety per tonne-kilometre.

### 2.6.2 Effects on Safety of Trucking Deregulation

Table 8(2)-15 can also be examined for evidence of trends in the three years, the latter two of which followed deregulation of trucking. The numbers concerned are small, but do seem to indicate that the accident involvement of heavy trucks increased after 1986, relative to all other vehicles. This is more pronounced for fatal accidents than non-fatal, and appears confined to "straight trucks" rather than tractor-trailer combinations. No traffic information is available, however, to explain whether this represents an increase in the fatal accident rate per vehicle-kilometre, an increase in vehicle-kilometres, or any change in operating conditions.

Evidence from the United States, which has many more trucks and accidents, allows more precise assessments. The conclusions of a seminar held in 1987 were that truck safety has continued to improve during the period since deregulation (a reduction from 64 fatal accidents per billion vehicle-kilometres in 1978, to an average of 54 between 1983 and 1985).[28] The U.S. Department of Transportation concluded more recently that, from 1977 to 1988, the rate of fatal crash involvements for single-unit trucks fell by one third, and the rate for combination trucks by 40%, while the rate for passenger vehicles declined by 25%.[29]

## 2.7 OVERALL TRENDS IN ROAD SAFETY[30]

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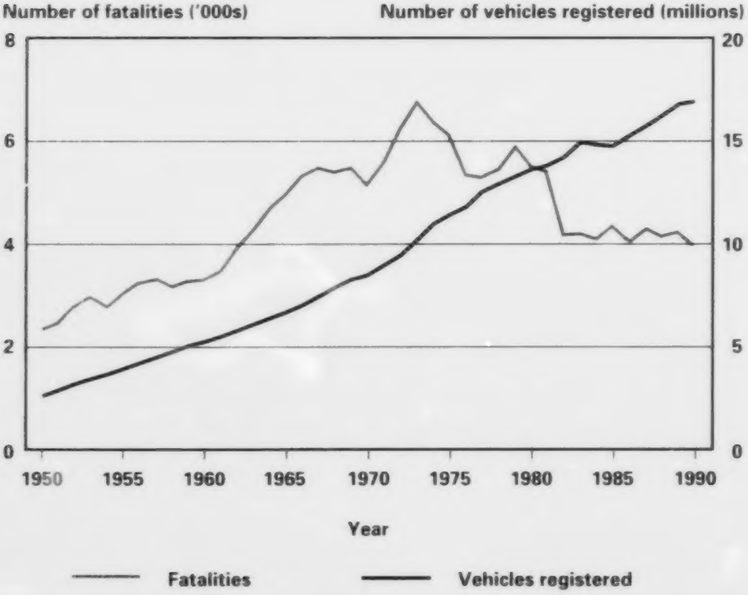
The trends in road traffic and safety from 1950 to 1990 are illustrated in Chart 8(2)-1 by two main indicators: the size of the motor vehicle fleet and the number of road accident fatalities. (Consistent estimates of vehicle-kilometres are not available.) Road traffic has grown almost without interruption since the invention of the motor vehicle. Since 1950, the vehicle fleet has become six times as large. The chart shows that deaths have increased with traffic, but not consistently. The number of deaths grew until 1973, and fell since then, but with substantial perturbations in the trend. Fatalities approximately trebled between 1950 and 1973, from 2,272 to 6,706. During this 24-year period, a total of 98,196 people died in road accidents.

Extrapolation of the simple trend observed prior to the year 1973 suggested that a further 230,000 would die in road accidents between then and the end of the century; and that over 130,000 would die between 1973 and 1990. In fact, the trend in fatalities changed quite abruptly after 1973. Since then, the annual toll has fallen almost every year. In 1990, it was 3,957, which was 40% lower than in 1973,

*Chart 8(2)-1*

*TRENDS IN ROAD TRAFFIC AND SAFETY, 1950 TO 1990*



and lower than in any year since 1962. For the period 1974 to 1990, the total deaths were 82,619, but this was one third lower than was predicted from the trend prior to 1973.

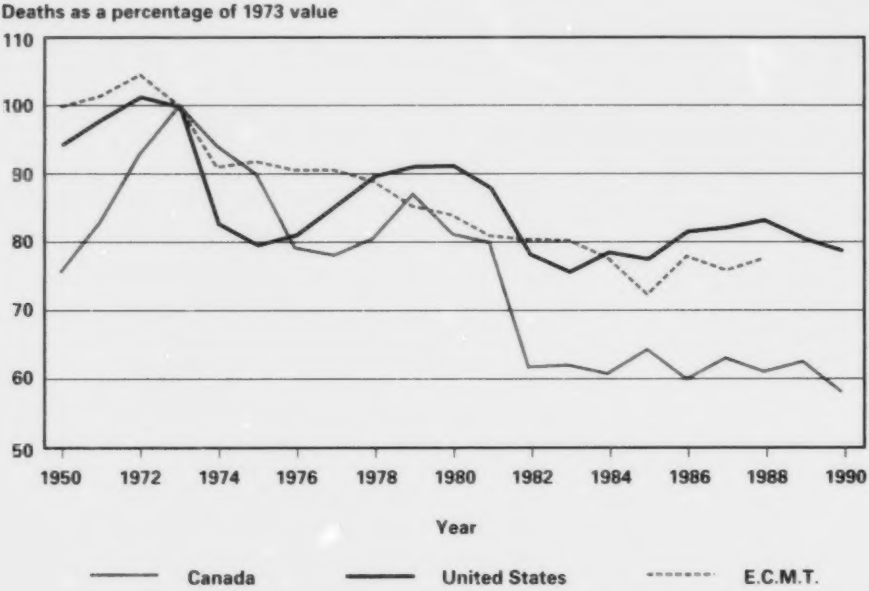
The trend to 1973 was of a long-term decline in the average rate of fatalities per vehicle as the vehicle fleet grew. There were, however, substantial fluctuations in that trend, including some sustained periods, such as 1961 to 1966 and 1970 to 1973, when fatalities grew faster than the vehicle fleet and faster than total traffic. Such periods can be shown (in other developed countries as well as Canada) to coincide with spurts in economic growth.[31]

Since 1973, the decline in the average fatality rate has been much sharper, and rose only in 1979 and 1985. While the rate of deaths per 10,000 vehicles fell from 8.7 to 6.6 in the 23 years between 1950 and 1973, it then fell by more than two thirds to 2.3 in the next 17 years to 1990. The sharpest reductions in the fatality rate occurred in 1974 and 1982, which were years of depressed economic activity. But strong economic growth between those years brought no more than a slight increase in deaths in 1979, and sustained growth from 1982 to 1989 produced no increase. It seems safe to conclude that a fundamental improvement in safety — a change in the underlying relationship of fatalities to traffic — has occurred since 1973.

Chart 8(2)-2 supports this conclusion with simple comparisons of trends in Canada with those in other developed countries. The chart shows fatalities represented by indices, with 1973 levels set to 100, for Canada, the United States, and a combined group of 19 countries of the European Conference of Ministers of Transport (ECMT). It is clear that there has been a much greater proportional reduction in fatalities in Canada than in these other countries since 1973, particularly since 1981.

*Chart 8(2)-2*

*INDEX OF FATALITIES, 1973=100*



Some major aspects of these improvements are summarized below.

*(i) Deaths by type of road user:* Driver fatalities have remained almost constant over the past couple of decades, and now amount to about 1,900 annually; while those of passengers have fallen to about 1,100 per year reflecting reductions in vehicle occupancies with increased motorization. Pedestrian deaths have shown the largest reduction, and there are less than half as many deaths (600) as 20 years ago. Motorcyclist deaths increased until about 1983, but have since declined by 40% to about 250 per year; and bicyclist deaths have remained relatively constant, at about 100 deaths a year.

*(ii) Deaths by age-group:* Assessing the period from 1957 to 1987 shows:

- Age-group 0 to 4 contributes only about 2% of deaths; the fatality rate per capita is less than one third of the average for all groups and has fallen faster than the average; the population of the group fell by 9%.

- Age-group 5 to 14 contributes about 6% of all deaths; the fatality rate per capita is less [illegible] half the average; population of the group declined 21% in the period.
- Age-group 15 to 24 contributes nearly 30% of all deaths — a remarkable over-representation; the fatality risk per capita is two and a half times that of the average of the other age-groups, but has recently fallen faster than the average; the population is larger than in 1970, but has contracted since 1980.
- Age-group 25 to 64 contributes 50% of all deaths; the fatality rate per capita fell overall by 40% over 20 years; the population grew by about 50%.
- Age-group 65 and over contributes nearly 15% of total deaths; the rate of fatalities per capita is slightly higher than the average for all age-groups and is falling faster than the average over the period; but growth in the population of the age-group is stronger than the reduction in its fatality rate per capita, so the absolute number of deaths in the group is rising.

### 2.7.1 Effects of Safety Measures

These trends show that the decline of fatalities in Canada can be explained partially through demographic changes, but mostly remains unexplained. The information available on the effectiveness of programs in road improvement, vehicle performance regulation, or road user education and control, however, is surprisingly poor. The complex relationships among contributing factors, and the poverty of data describing them, have meant that efforts at modelling and explaining the processes have not been very successful. Gaudry's modelling of relationships between social factors and accidents in Quebec is unusual in allowing recognition of the influences of a number of the factors with some statistical confidence.[32] But the introduction of safety measures is rarely immediate enough or sufficiently widespread so that the effects could be assessed accurately even with such a model.

Furthermore, an intriguing aspect of the overall trends is that, in one way, they appear simple to describe: that is, in the long-term decline in the fatality rate per vehicle (or vehicle-kilometre). Researchers have shown in a number of countries that a simple curve describes how the fatality rate declines as the level of motorization (vehicles per capita) grows.[33] They further suggest that the relationships are very similar in many countries — in other words, that different countries have very similar fatalities per vehicle at the same level of motorization. Although this generalization is attractive, it would worry safety programmers because it suggests that safety programs are a waste of time and that improvement over time is inexorable with increasing motorization.

The notion of such a simple determination of the fatality rate is countered by evidence that there are important changes in the relationship over time in any country, and among countries.[34] A substantially different interpretation of the change in the fatality rate over time has recently emerged, particularly from researchers at the Institute for Road Safety Research in The Netherlands.[35] They suggest that the trend in the fatality rate can best be described by a very simple relationship derived from mathematical "learning theory." This they interpret to mean that the phenomenon of a declining fatality rate results from "social learning" about safety — a growing understanding by all involved of the means of controlling motorization. The part played by all the various safety programs still remains conjectural — these researchers suggest that the progressive implementation of safety measures has been part of social learning, but have no specific evidence for their effects.

Such evidence should have accumulated from evaluations of specific safety measures using laboratory experiments, or careful observations of the effects of measures that have been implemented. Unfortunately, it has proven difficult to predict from laboratory experiments how safety measures will be received when implemented (for example, how drivers will react to changes in road markings, or to improvements in vehicle performance). In particular, it has been found that road users adapt their behaviour to changes in equipment or controls, and often in a way that reduces the intended safety gain.[36] One hypothesis has held that adaptation is intended to keep risks constant,[37] while other empirical evidence shows that the extent of adaptation is unpredictable.[38]

To identify the effects specific to a safety measure, evaluations of its implementation attempt to control for changes in traffic and other extraneous factors. Unfortunately, most evaluations are controlled poorly, and many evaluations are subject to upward biases in their estimates of safety improvements,[39] so all claims for the effects of preventative measures should be viewed with great suspicion.

In sum, there are not many measures that safety researchers would agree have been demonstrated to be effective. The list would probably include:

- a number of major highway improvements (generally for capacity expansion purposes), including grade separation, straight and flat alignments, and paved shoulders;
- guardrails, crash barriers and edge-linings;
- minor improvements on roads at "black spots," for example, to sight-lines, surface conditions, traffic signs and controls;[40]
- a number of U.S. and Canadian motor vehicle performance standards, particularly those for crashworthiness, including standards for deflecting steering columns, side door beams, windshields, door locks, seat belts and air bags;[41]
- seat-belt use laws and their enforcement;[42] and
- random breath testing to enforce laws against drunk-driving.[43]

The list would probably not include some very popular remedies, such as motor vehicle inspection,[44] high-school driver education,[45] and most public information campaigns.[46]

### 2.7.2 Possible Future Trends

Some of the trends noted earlier can be expected to continue. One of the major changes noted was the disproportionate reduction in pedestrian and passenger fatalities. The reduction in pedestrian fatalities should slow because the changes were proportionately so large, and because underlying contributors, such as the decline in the child population and school consolidation, have slowed. Passenger fatalities could continue to drop relative to driver fatalities if the vehicle fleet continues to grow faster than the population, because vehicle occupancies could be expected to continue to fall.

The effects of future demographic trends must also be factored into the predictions. The contraction of the youngest age-group appears to have ceased, and the child population can be expected to be more stable in the immediate future. The group 25 to 64, with an aggregate fatality rate that is close to the average, will continue to provide the bulk of total population growth. The oldest age-group, over 64, will also continue to grow fastest, exerting an upward pressure on average fatality rates. For the next decade or so, this will be more than offset by the continuing contraction in the young adult group aged 15 to 24, with its very disproportionate risks.

Overall, none of these effects seems likely to be very dominant in changing the fatality rate from its current level. The main determinant of the change in fatalities will continue to be the change in the traffic. As represented by the size of the vehicle fleet, total traffic seems likely to follow its historical growth at a faster rate than the population.

Fatality rates, however, can probably be expected to continue to fall over time. It seems likely that driving activity will increase more in conditions with lower risks (more urban than rural driving, for example, and at slower speeds because of congestion), and among drivers with lower than average risk, as driving activity continues to broaden demographically (involving more women and older people). Reductions should be reinforced by the lagged effects of recent safety measures, and by the impacts of anticipated new measures. It can be expected that air bags will be introduced in all cars and light trucks, and that further vehicle standards will be introduced to improve crashworthiness (especially in side impacts) and crash avoidance (for example, through anti-lock brakes and hazards warning, or even automatic hazards avoidance). It can also be expected that highway safety will be improved by paving shoulders, removing roadside obstacles, and constructing further grade-separated highways.

In the longer term, the introduction of Intelligent Vehicle-Highway Systems holds the prospect of extraordinary improvements in safety (as well as traffic capacity). Once two-way vehicle communication systems are established for navigation (which will likely be broadly available in congested cities within 20 years), the development of vehicle control systems is likely to proceed swiftly, offering the possibility of vehicle queue control. Combined with the development of enhanced on-board vehicle control systems, and, ultimately, autonomous systems, these seem capable of greatly reducing crashes.

## 3. VALUES OF ACCIDENT LOSSES

### 3.1 ESTIMATES OF LOSS COSTS IN ACCIDENTS IN CANADA

Most of the work to estimate accident losses has been done in relation to road safety.[47] A number of different cost items might be distinguished:

- damage to vehicles and other property;
- health care for victims;
- lost employment and other "work efforts" of victims;
- time and efforts of police and other emergency services;
- pain, suffering or mental anguish suffered by victims and others;
- lost home, family or community services of victims;

- legal and court proceedings to establish fault, compensation, and so on;
- administration of insurance claims; and
- efforts of family or friends in attending victims.

With a little ingenuity, the list can be extended considerably to include a number of other losses and irritations that affect the victim, the family, employer and social contacts, and that require social resources to correct.

Most of the items on the list would be difficult to identify and estimate, and some might be impossible to measure. The "subjective" costs of victims' pain and suffering obviously present the most problems, but a number of other items, such as losses of services in the home or other family and community services, are normally unpaid and are difficult to assess monetarily.

Transport Canada has attempted to estimate values for all of these losses, and show that three major items dominate (in this order): property damage, lost work, and health care costs. Costs of property damage are estimated from insurance company claims records, with allowances for unclaimed damage. Costs of lost work are estimated from durations of disability and average expectations of lifetime income, with allowance for unpaid efforts at alternative market rates. Health care costs are estimated primarily from payment records from the provincially owned motor-vehicle insurance administrations in Quebec and British Columbia.

Estimates of the losses (rounded) are shown in Tables 8(2)-17 to 8(2)-21, as total amounts for the year 1990, as averages per accident by severity, and as averages per victim by severity (the average accident including more than one victim, plus property damage).

### Table 8(2)-17
### ESTIMATED VALUES OF TOTAL LOSSES IN ROAD ACCIDENTS, 1990

| Type of loss | Amount ($ billion) |
|---|---|
| Property damage | 5.0 |
| Lost work | 3.5 |
| Health care | 0.5 |
| **Total** | **9.0** |

**Source: J.J. Lawson, *The Valuation of Transport Safety*, updated by author to 1990.**

### Table 8(2)-18
### ESTIMATED LOSSES PER ACCIDENT, 1990

| Severity of accident | Loss per accident ($) |
|---|---|
| Fatal | 400,000 |
| Injury | 25,000 |
| Damage only | 5,000 |

**Source: Lawson, *The Valuation of Transport Safety*, updated by author to 1990.**

### Table 8(2)-19
### ESTIMATED LOSSES PER VICTIM, 1990

| Severity of injury | Loss per victim ($) |
|---|---|
| Fatal | 330,000 |
| Non-fatal | 10,000 |

**Source: Lawson, *The Valuation of Transport Safety*, updated by author to 1990.**

*Table 8(2)-20*

ESTIMATED LOSSES PER ACCIDENT BY TYPE OF LOSS, 1990

| Class of accident | Health care ($) | Work loss ($) | Property damage ($) | Total ($) | Number of accidents |
|---|---|---|---|---|---|
| Fatal | (few) | 400,000 | 10,000 | 400,000 | 3,340 |
| Injury | 2,000–3,000 | 12,000 | 10,000 | 25,000 | 178,854 |
| Damage only | nil | nil | 5,000 | 5,000 | 650,000 |

**Source:** **Lawson, *The Valuation of Transport Safety*, updated by author to 1990.**

*Table 8(2)-21*

ESTIMATED TOTAL LOSSES IN ALL ROAD ACCIDENTS BY TYPE OF LOSS, 1990
(BILLIONS OF DOLLARS)

| Class of accident | Health care | Work loss | Property damage | Total |
|---|---|---|---|---|
| Fatal | (few) | 1.4 | (few) | 1.4 |
| Injury | 0.5 | 2.1 | 1.8 | 4.4 |
| Damage only | nil | nil | 3.2 | 3.2 |
| **Total** | **0.5** | **3.5** | **5.0** | **9.0** |

**Source:** **Lawson, *The Valuation of Transport Safety*, updated by author to 1990.**

## 3.2 HEALTH CARE LOSSES: WHO PAYS?

Surprisingly little information is available on the extent and costs of health care for victims of transportation accidents, partly because the health care system is more concerned with recording diagnoses and treatments than causes of ill-health, and partly because hospitals and provincial medical insurance schemes do not attribute treatment costs to individual victims, but average their costs per day and charge victims for the number of days treated.

The values in the tables come from Quebec and British Columbia, where the provincial motor-vehicle insurance agency reimburses the department of health for treatment of road accident victims. In both provinces, the agreed amount in each year is a lump sum estimated by the department of health as the costs it incurred.

The amounts in 1990 were about $1,250 per reported road accident victim in British Columbia, and about $2,500 per reported victim in Quebec.[48] Adjusting for a higher average severity of injury to victims in Quebec, the national average is estimated to be $1,500 to $2,000 per reported victim. In 1990, the total would be rounded up to about $500 million for the 263,000 reported victims. Note that this average per reported victim is much lower than the individual costs of treatment for those who received health care, because about 35% of all reported victims received no medical treatment, another 55% received only out-patient treatment, and only about 10% were admitted to hospital.

Of the total of about $500 million, the Quebec and British Columbia insurance corporations — through their policy-holders — paid nearly $200 million. In Ontario, since the introduction of "no-fault" motor-vehicle insurance in 1990, the entire amount has been paid from provincial medical insurance budgets — and that probably amounted to between $200 million and $220 million in 1990. (Previously, the provincial health agency was able to recuperate the costs of health care from vehicle insurance companies when their clients were found responsible, and operated a bulk payment agreement by which the companies paid a flat rate of 2.5% of liability insurance premiums to cover those health care costs.)

In Saskatchewan, the provincially owned motor-vehicle insurance corporation is held liable by the provincial health insurance systems for the health care costs of victims who are negligent in accidents, but those are a small minority of victims. (In Saskatchewan, the payment this year amounts to about $3 million.[49]) The rest of the cost is borne by provincial health insurance. In the remaining provinces, the private vehicle insurance companies can be held responsible for the health care costs of those found at fault (as used to be the case in Ontario). This must be done case by case, however, and so reimbursement is not pursued systematically — probably most often when costs are higher and negligence is more firmly established.

In summary, it seems probable that for road accident victims roughly as much as $300 million of health care costs are borne annually by health insurance plans, and about $200 million by motor vehicle owners (essentially only in Quebec and British Columbia).

For other modes, no information is available whether provincial health care authorities recover health care costs. It seems less likely that recovery would be achieved for these modes, because the assignment of responsibility is probably less formal than is the case with road accidents (where police normally determine responsibility, and fault-finding procedures are well established in insurance legislation or by customary practice). Therefore, it seems probable that health care systems and the people who pay for them meet all the costs of care for accident victims in these other modes. However, there are also many fewer casualties compared with those in road accidents. The total health care costs, in 1990, for road casualties (urban as well as interurban) related to 3,957 fatalities and 263,000 injuries. Comprehensive and comparable records of the number of injured victims in the other modes are not available, but their total annual number is likely much less than 1,000. The largest number would be in bus accidents, which subsection 2.3 suggests were about 170 annually from 1985 to 1987. The next largest group would be victims of train accidents. Transportation Safety Board records show that the ratio of injured victims to fatalities from 1981 to 1990 was fewer than five to one, in which case the annual number in accidents involving passenger trains and excluding grade crossing accident victims (counted as road accident victims) would be fewer than 80. For accidents involving aviation, in which about 60 people died annually during the decade, it seems likely that the ratio of injured to killed is very low (because aviation accidents are so severe). Finally, ferry accidents are so rare that fewer than one person was killed annually in the decade, and the number of injured was likely to be fewer than 10 per year.[50] Health care costs for all injured victims in the public modes would then have been less than $2 million in 1990, if costs per victim were the same as for road accident victims.

## 3.3 ALTERNATIVE VALUATIONS OF ACCIDENT LOSSES, FROM "WILLINGNESS TO PAY"

Academics have debated the appropriate "value of life" for a century or more. Most of the argument has centred on the value of improvements in safety brought by public investments. The predominant view among economists is currently that intangible benefits in benefit-cost analysis should be given money values based on what the beneficiaries would be willing to pay for them. The view of specialist, safety economists is also that the benefit from a safety improvement is the risk reduction gained by the population at risk, and that its value is whatever people would be willing to pay for the psychological satisfaction they gain.

From this viewpoint, the value of avoiding accidents and their consequences need bear no direct relationship to the costs of sustaining those consequences. Rather than valuing safety by adding up the costs of people dying, it proposes that we add up what the population at risk is willing to pay to reduce the specified chance of dying.

Researchers have considered the following sources:

- insurance premiums paid by individuals;
- court awards of compensation to accident victims;
- values of safety implied by previous government decisions;
- premiums received by workers in risky jobs;
- amounts paid by consumers for safety devices; and
- amounts individuals say they would pay for hypothetical risk reductions.

The first three sources are inappropriate for appraising safety improvements. Insurance premiums address only risks of personal financial losses, and cannot incorporate loss of a victim's own life or physical suffering. Court awards are circumscribed by law and precedent, and tend to be paid in unrepresentative circumstances, in which negligence can be shown, and/or losses are large. Values implied by previous government decisions reveal what hindsight shows the government to have accepted, when rarely was the trade-off explicit, and shows major inconsistencies.

The other three potential sources are cases where individuals trade money for safety, and are considered to be legitimate approaches to finding "willingness to pay" for safety. Worldwide, only about 40 of these empirical studies have been undertaken.[51] It is very difficult to find credible situations in which safety is traded for money in an identifiable way — when the change in risk that is being purchased, and the amount of money involved, are obvious to both the purchaser and the researcher.

Most of these studies compare wage premiums paid for job risks. In these studies, the researcher normally has only some broad estimates of average risks existing in various industries, and must assume that each worker recognizes and trades precisely those risks in deciding where to work. That seems implausible, as does the presumption in the studies that the risk premiums are unaffected by bargaining conditions such as trade union power.

In studies of consumer purchases of safety devices, it is even more difficult to determine what risk reduction consumers believe they are obtaining. Researchers seldom find it possible even to obtain an objective estimate of the risk reduction involved. Such studies are, consequently, extraordinarily rare. The favoured alternative approach is to consider situations in which travellers trade time for safety, and to infer a value for safety from an assumed money value for their time. These add the complications of the great uncertainties in determining values of time to those of revealing the nature of the traded risk.[52]

Finally, the survey approach, asking people the values they would pay for hypothetical risk reductions, manages to avoid the problems of recognizing the risk changes involved, as these are specified in the questions. It faces the criticism, however, that hypothetical responses might relate only poorly to behaviour, and it introduces a number of specific problems in respondents' ability to understand and manipulate small numerical risks.

The behavioural studies we reviewed provide estimates for the value of avoiding a death ranging from less than $200,000 to more than $50 million. The view of some economists[53] is that the best of these can be judged to centre on about $1 million to $3 million, and that such values should be used in benefit-cost analysis. The view of others[54] is that the results of the studies do not allow a confident finding of a central value, or schedule of values of different risks. They also believe there is currently no substitute for either using minimum values based on material losses (Tables 8(2)-17 to 8(2)-21), or obtaining a political judgement of the values of safety to use in benefit-cost analysis, based on the relative priority to be given to safety among other objectives of government action.

## 3.4 CURRENT PRACTICE AT TRANSPORT CANADA

The policy on valuing safety at Transport Canada has undergone a radical change, with adoption in 1992 of a single value for a death avoided of $1.5 million, in 1991 dollars. Recent practice differed substantially among different parts of the Department, with values in 1989 dollars varying from $310,000 in road safety evaluations to as high as $2.9 million in some aviation investment evaluations. The differences were not created by income differences in the victims (by mode), but resulted from different interpretations of the literature on willingness-to-pay valuations. The position taken for road safety evaluations was that willingness-to-pay research had not provided convincing estimates, so the value used was a minimum estimate based on material losses, while the value used in aviation evaluations reflected a judgement that some of the willingness-to-pay research provided defensible values.

The current position of Transport Canada's Economic Evaluation Branch is that a single value should be used throughout the Department, and that $1.5 million is appropriate.

## 3.5 RECENT FOREIGN PRACTICE

Values for transport safety are used routinely in many countries, particularly in road investment analysis. Recent official values of transport safety were as follows:

| | Approximate $ Can., 1989 |
|---|---|
| United States: | |
| Federal Highway Administration (FHWA)[55] | 2,400,000 |
| Federal Aviation Administration (FAA)[56] | 2,500,000 |
| Department of Transportation (DOT) General Counsel[57] | 1,600,000 |
| United Kingdom[58] | 1,000,000 |
| Australia[59] | 480,000 |
| Germany[60] | 850,000 |
| Finland[61] | 950,000 |
| France[62] | 350,000 |
| Sweden[63] | 950,000 |

Values for road safety in most of the countries have been based on the measurable money losses, due to an admitted inability to reveal values in any other way. This is true in Australia, Germany, France, and, until recently, the United Kingdom. As these losses consist mainly of the earnings expected to be lost over a lifetime, most of the differences among the countries arise through differences in wage rates and discount rates. (Canada's Road Safety values were lower than most because of a higher discount rate.)

The value shown for the United Kingdom was the result of an explicit ministerial decision to nearly double the previous value because it gave insufficient priority in road improvement decisions to safety compared with saving time and operating costs, and therefore favoured proposals that increased road traffic volumes or speeds at the expense of safety.[64] The value has subsequently been argued to represent a reasonable median value from the willingness-to-pay research.[65]

The value shown for the U.S. DOT General Counsel also reflects a political decision in 1986 on the minimum value to be defended in public by that department. It is now superseded at FHWA and FAA by the higher values recently proposed by those agencies, on the basis of a consultant's assessment that the research evidence converges to those values.

# ENDNOTES

1. The term "casualty" refers to either death or injury.

2. "Risk" is used to refer to a **rate** of accidents or casualties per unit of traffic (for example, vehicles, veh-km or pass-km).

3. Total car/light-truck highway traffic is estimated at 210 billion pass-km in 1991. Transferring 1% of that, or 2.1 billion pass-km, with an average risk of 13 deaths per billion pass-km would save about 27 road deaths, while if it achieved the average risk for Levels 1 and 2 air carriers combined, of 0.13 deaths per billion pass-km, expected aviation deaths would rise by only 0.27.

4. A particularly interesting recent comparison of risks between road and air suggests that a typical U.S. business traveller who is sober, in a large car, in daylight, on limited-access highways faces a **lower** risk than on a scheduled flight for distances up to 1 000 km! (L. Evans, M.C. Frick and R.C. Schwing, "Is it safer to fly or drive?," *Risk Analysis* 10(2) (1990), pp. 239–246).

5. Passenger-kilometres reported by Statistics Canada are for carriers of Levels 1 to 4, so this 3.5% share actually represents carriers of Levels 3 and 4, rather than 3 to 6. However, it is expected that the passenger traffic carried by Levels 5 and 6 is so small as to be almost negligible in the total for Levels 3 to 6, and in the estimation of fatality rates per pass-km for this class of carriers. In support of that contention, it can be noted that prior to 1981, Statistics Canada reported pass-km for Level 5 carriers on unit toll services, and that, in 1980, those carriers provided less than 0.7% of the pass-km reported on services by carriers of Levels 3 and 4, and that the proportion had declined substantially since 1976 (Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, 1975–1981 issues, Table 1 or 1.2).

6. Personal communication between a Transportation Safety Board official and Royal Commission staff.

7. The crash of a Nationair aircraft in Jeddah in 1991, which claimed 261 lives, will substantially change the long-term fatality rates estimated for Canadian carriers as a whole, and that for the Level 2 carriers quite dramatically. The 10-year average passenger fatality rate per billion pass-km for Level 2 carriers will rise from 0.7 to about 4.6, and the combined rate for Levels 1 and 2 from about 0.1 to 0.6.

8. U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Series Q, Air Transportation (Washington D.C.: 1976) and *Statistical Abstract of the United States* (Washington, D.C.: 1970 to 1990).

9. G. Dionne, R. Gagné and C. Vanasse, *A Statistical Analysis of Airline Accidents in Canada 1976-87* (Montreal: Univ. of Montreal, Centre for Research on Transportation, May 1991).

10. For summaries see: D.L. Golbe and L. Lazarus, "Summary and Policy Implications for Air," *Transportation Deregulation and Safety, Conference Proceedings* (Northwestern University Transportation Center, June 1987), pp. 513–17; L.N. Moses and I. Savage, "Summary and Policy Implications, The Airline Industry," in *Transportation Safety in an Age of Deregulation*, eds. L.N. Moses and I. Savage (New York: Oxford University Press, 1989), pp. 308–320; L.N. Moses, and I. Savage, "Aviation Deregulation and Safety: Theory and Evidence," *Journal of Transport Economics and Policy*, May 1990, pp. 171–88.

11. T.G. Moore, "The myth of deregulation's negative effect on safety," in *Transportation Safety in an Age of Deregulation*, eds. L.N. Moses and I. Savage, pp. 8–27.

12. C.V. Oster, and C.K. Zorn, "Is it still safe to fly?," in *Transportation Safety in an Age of Deregulation*, pp. 129–152.

13. Moore "The Myth Of," Table 2.1, p. 14.

14. Oster and Zorn, "Is it still safe to fly?," Table 10.3.

15. See Oster and Zorn "Is it still safe to fly?," Table 10.4; and R.J. Gordon, "Productivity in the Transportation Sector," *NBER Working Paper No. 3815* (Cambridge, Mass.: National Bureau of Economic Research, August 1991).

16. L.F. Bylow and I. Savage, "The Effect of Airline Deregulation on Automobile Fatalities," *Accident Analysis and Prevention* 23 (5), (1991), pp. 443-52.

17. Problems of interpretation mean that it is possible that some intercity bus accidents and their victims were not identified.

18. As noted in Volume 1, Chapter 13, these ferries comprise the marine ferries on the west and east coasts, together with the crossings of the St. Lawrence tidal estuary in Quebec, and the Tobermory-South Baymouth service in Lake Huron.

19. Personal communication from Transportation Safety Board staff to Royal Commission staff, Dec. 2, 1991.

20. It is not possible from the available evidence to observe whether the annual fatalities were changing through the decade. Ferry traffic (measured by number of passengers carried) grew substantially through the decade, but no equivalent growth in fatalities can be seen in Table 8(2)-14.

21. P. Gutoskie, *Road Accident Statistics in Canada — 1989*, Report TP 10812, Road Safety Directorate (Ottawa: Transport Canada, March 1991), Table A14. The subsequent publication for 1990 records the number of "rural" fatalities as 2,654 (TP 11230, Jan. 1992).

22. Royal Commission staff estimate, based on 420,000 heavy trucks assumed in use in 1989, and kilometres per vehicle as estimated in F. Nix, M. Boucher and B. Hutchinson, "Road Costs," in Volume 4 of this report.

23. Note that Nix et al. estimate that heavy trucks travel some 2.5 times as many kilometres per vehicle per year as cars and light trucks (44,000 compared with 17,600), in which case their rate of fatal accident involvement per vehicle-kilometre can be inferred to be only 40% of that for cars and light trucks (or 1 ÷ 2.5).

24. E.R. Welbourne and P. Gutoskie "Heavy Truck Accidents, Casualties and Countermeasures," *Proceedings of the Canadian Multidisciplinary Road Safety Conference VI*, (Fredericton, N.B.: University of New Brunswick, 1989), pp. 183–93.

25. Transportation Association of Canada, Interjurisdictional Committee on Vehicle Weights and Dimensions, *Summary of Weight and Dimension Regulations for Interprovincial Operations, Resulting from the Memorandum of Understanding on Interprovincial Weights and Dimensions* (Ottawa: TAC, Sept. 1989).

26. See, for example, G. Sparks et al., *The Safety Experience of Large Trucks in Saskatchewan* (Saskatchewan Highways and Transportation, Spring 1988).

27. Transportation Research Board, "Twin Trailer Trucks," *Special Report 211* (Washington, D.C.: National Research Council 1986).

28. R.P. Schweitzer, "The Myth of Economic Deregulation and Safety in the U.S. Motor Carrier Industry," *Transportation Deregulation and Safety* (Northwestern Univ. Transportation Center, June 1987), pp. 693–710.

29. U.S. DOT, National Highway Traffic Safety Administration, "A Summary of Fatal and Nonfatal Crashes Involving Medium and Heavy Trucks in 1988," draft report, February 1990.

30. Much of the following description is derived from J.J. Lawson, *Long Term Trends in Road Safety*, Report TP 9417 (Ottawa: Transport Canada, July 1988).

31. Traffic in vehicle-kilometres is estimated in Canada only approximately from fuel sales. Evidence from countries with more direct measures of vehicle-kilometres confirms that fatalities grew faster than traffic in these periods; see European Conference of Ministers of Transport, *Statistical Report on Road Accidents*, Paris, annual.

32. M. Gaudry, "DRAG, un modèle de la Demande Routière, des Accidents et de leur Gravité, appliqué au Québec de 1956 à 1982," Publication #359, (Montreal: Univ. of Montreal, Centre for Research on Transportation, Univ. of Montreal, October 1984).

33. See, for example, (in chronological order) R.J. Smeed, "Some Statistical Aspects of Road Safety Research," *J Royal Stat. Soc.*, A(1) (1949), pp. 1–34; J.G.U. Adams, *Risk and Freedom: the Record of Road Safety Regulations* (Cardiff: Transport Publishing Projects, 1985); J.G.U. Adams, "Smeed's Law: Some Further Thoughts," *Traffic Engineering and Control* 28(2) (Feb. 1987), pp. 70–73; and J. Broughton, "Predictive Models of Road Accident Fatalities," *Traffic Engineering and Control* 29 (May 1988), pp. 296–300.

34. See, for example, D.C. Andreassen, "Linking Deaths with Vehicles and Population," *Traffic Engineering and Control* 26(11), Nov 1985, pp. 547–9.

35. S. Oppe, M.J. Koornstra and R. Roszbach, "Macroscopic Models for Traffic Safety," *International Symposium of Traffic Safety Theory and Research Methods, Session 5*, (Leidschendam, The Netherlands: Institute for Road Safety Research (SWOV), April 1988); S. Oppe, "The Development of Traffic and Traffic Safety in Six Developed Countries," *Accident Analysis and Prevention* 23(5) (1991) pp. 401–412; S. Oppe, "Development of Traffic and Traffic Safety: Global Trends and Incidental Fluctuations," *Accident Analysis and Prevention* 23(5) (1991) pp. 413–422.

36. For a specific example, see K. Rumar, U. Berggrund, P. Jernberg and U. Ytterbom, "Driver Reaction to a Technical Safety Measure — Studded Tyres," *Human Factors*, 18 (1976), pp. 443–54; for a recent major summarization of the issues, see Organisation for Economic Co-operation and Development, Road Transport Research, *Behavioural Adaptation to Changes in the Road Transport System* (Paris: OECD, 1990).

37. G.S. Wilde, "The Theory of Risk Homeostasis: Implications for Safety and Health," *Risk Analysis* 2 (1982), pp. 209–25.

38. L. Evans, "Human Behaviour Feedback and Traffic Safety," *Human Factors* 27 (1985), pp. 555–76.

39. E. Hauer, "On the Estimation of the Expected Number of Accidents," *Accident Analysis and Prevention* 18 (1) (1986), pp. 1–12.

40. See summary of research in P.J. Cooper, *Benefit/Cost Assessment of Some Major Traffic Accident Countermeasures in British Columbia* (Vancouver: Insurance Corporation of British Columbia, Jan. 1985).

41. See summary in R.W. Crandall et al., *Regulating the Automobile* (Washington: The Brookings Institution, 1986).

42. See summary in U.S. Department of Transportation, National Highway Traffic Safety Administration, *Effectiveness of Safety Belt Use Laws: A Multinational Examination*, Report DOT HS 807018 (Washington, D.C.: DOT, Oct. 1986).

43. See, for example, Australia, Federal Office of Road Safety, *Drink Driving Controls in Australia* (Canberra: Dept. of Transport, Aug. 1986).

44. See U.S. Department of Transportation, National Highway Traffic Safety Administration, *Study of the Effectiveness of State Motor Vehicle Inspection Programs, Final Report*, Report HS 807468 (Washington, D.C.: DOT, Sept. 1989).

45. See J.R. Stock et al., *Evaluation of Safe Performance Secondary School Driver Education Curriculum Demonstration Project, Final Report* (Springfield, VA: National Technical Information Services, 1983).

46. Organisation for Economic Co-operation and Development, *Road Research Programme: Road Safety Campaigns: Design and Evaluation* (Paris: OECD, Dec. 1971).

47. For a review of recent literature, see J.J. Lawson, *The Valuation of Transport Safety*, Report TP 10569 (Ottawa: Transport Canada, Economic Evaluation Branch, May 1989), on which much of the following discussion is based.

48. Total payments for the year were obtained through personal communication with staff of the Insurance Corporation of British Columbia and Société de l'Assurance Automobile du Québec, and totals were divided by number of reported victims to obtain the above averages. Total payment in Quebec was reported for 1985 in B. Bordeleau, *Évaluation des coûts de l'insécurité routière au Québec* (Quebec: Régie de l'assurance automobile du Québec, Dec. 1988), p. 43.

49. Personal communication with staff of SGI Corp.

50. Transportation Safety Board, *Annual Report 1990* (Ottawa: Supply and Services Canada, 1991), records (Table A-2) some 1,132 injured and 168 killed in all accidents involving Canadian commercial vessels (including accidents aboard ships), during 1981–1990, a ratio of 6.7 injured to each death.

51. A number of which are reviewed in some detail in Lawson, *The Valuation of Transport Safety*, on which the following assessment is based.

52. For summaries of efforts to estimate the value of time, see Lawson, JJ, *The Value of Travel Time for Use in Economic Evaluations of Transport Investment: An Assessment of the Research Findings*, Report TP 10569 (Ottawa: Transport Canada, Economic Evaluation Branch, March 1989); or W.G. Waters II, *The Value of Time Savings for the Evaluation of Highway Investments in British Columbia* (Vancouver: University of British Columbia Centre for Transportation Studies, 1992).

53. Prominently Miller; see, for example, T.R. Miller, S. Luchter and C.P. Brinkman, "Crash Costs and Safety Policy," *Accident Analysis and Prevention* 21(4) (1989), pp. 303–16.

54. For example, Lawson, *The Valuation of Transport Safety*.

55. U.S. Department of Transportation, Federal Highway Administration, *Technical Advisory T 7570.1: Motor Vehicle Accident Costs* (Washington, D.C.: DOT, June 30, 1988).

56. Personal communication with staff of U.S. Dept. of Transportation, Federal Aviation Administration.

57. Memorandum from General Counsel, Office of the Secretary, U.S. Dept. of Transportation, to "Regulation Council Members," on the subject of "Value of a Life," dated April 10, 1986.

58. U.K. Dept. of Transport, *Values for Journey Time Savings and Accident Prevention* (London: Dept. of Transport, 1987).

59. L.A. Steadman and R.J. Bryan, *Costs of road accidents in Australia*, Occasional Paper 91 (Canberra: Bureau of Transport and Communications Economics, 1988).

60. R. Krupp, *Extent, Severity and Economic Costs of Permanent Injuries Caused in Road Accidents* (Bergisch Gladbach: Bundesanstalt für Strassenwesen, May 1984), updated by personal communication from Dr. Krupp.

61. N. Halla, A. Tevajarvi, *User Costs in Road Traffic 1988* (Helsinki, Finland: Roads and Waterways Administration, April 1988).

62. H. Duval, *La valeur monétaire d'une vie humaine*, Cahier d'Étude 58 (Arceuil: Organisme national de sécurité routière, March 1983).

63. Vagverket, Serviceavdelning Planering och Projectering: *Objektanalys 18. Effektkatalog Vag- och gatuinvesteringar* (Borlange, Sweden: Vagverket (Swedish Road Administration), July 1986).

64. Quoted in "Values Placed on Road Deaths," *Traffic Engineering and Control* 29 (July/Aug. 1988), p. 423.

65. M.Q. Dalvi, *The Value of Life and Safety: A Search for a Consensus Estimate* (London: Dept. of Transport, 1988).

# NOTES TO CHAPTER 9: LEGISLATION, REGULATIONS AND RELATED DEVELOPMENTS AFFECTING PEOPLE WITH TRANSPORTATION-RELEVANT DISABILITIES

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# INTRODUCTION

These notes provide background information on the accessibility of transportation to people with disabilities. The topics covered include:

1. the current legislative base;
2. National Transportation Agency orders and regulations;
3. major events, studies and inquiries; and
4. a comparison of U.S. and Canadian legislation and regulations designed to improve transportation accessibility.

# 1. LEGISLATIVE BASE

Early in Chapter 9, Volume 1, the current situation relating to Canadians with transportation-relevant disabilities is described. One key to understanding this situation is a knowledge of the legislation that provides the principles to be observed in improving access to transportation services for travellers with disabilities. This section quotes these legislative provisions and briefly describes how they interrelate.

## 1.1. THE *NATIONAL TRANSPORTATION ACT, 1987*

The *National Transportation Act, 1987*[1] (NTA, 1987) applies to all federally regulated modes of transportation. For passenger services this includes all air, most rail, and some bus and marine services. Paragraph 3(1)(g) of the Act provides that:

> each carrier or mode of transportation, so far as practicable, carries traffic to or from any point in Canada under fares, rates and conditions that do not constitute . . . an undue obstacle to the mobility of persons, including those persons who are disabled. . . .

The NTA, 1987 also provides direction to the National Transportation Agency concerning its specific role in improving access to transportation services for people with disabilities. This direction took effect through the July 1988 amendments to the Act that read as follows:

> 63.1(1) The [National Transportation] Agency may, with the approval of the Governor in Council, make regulations for the purpose of eliminating undue obstacles in the transportation network governed by this Act to the mobility of disabled persons, including regulations respecting
>
> (a) the design, construction or modification of, and the posting of signs on, in or around, means of transportation and related facilities and premises, including equipment used in them;
>
> (b) the training of personnel employed at or in those facilities or premises or by carriers;
>
> (c) tariffs, rates, fares, charges and terms and conditions of carriage applicable in respect of the transportation of disabled persons or services incidental thereto; and
>
> (d) the communication of information to disabled persons.
>
> (2) Regulations made under subsection (1) incorporating standards or enactments by reference may incorporate them as amended from time to time.
>
> (3) The Agency may, with the approval of the Governor in Council, make orders exempting specified persons, means of transportation, services or related facilities and premises from the application of regulations made under subsection (1).

63.2 The Agency and the Canadian Human Rights Commission shall co-ordinate their activities in relation to the transportation of disabled persons in order to foster complementary policies and practices and to avoid jurisdictional conflicts.

63.3(1) The Agency may, of its own motion or on application, inquire into a matter in relation to which a regulation could be made under subsection 63.1(1), regardless of whether such a regulation has been made, in order to determine whether there is an undue obstacle to the mobility of disabled persons.

(2) Where the Agency is satisfied that regulations made under subsection 63.1(1) that are applicable in relation to a matter have been complied with or have not been contravened, the Agency shall determine that there is no undue obstacle to the mobility of disabled persons.

(3) On determining that there is an undue obstacle to the mobility of disabled persons, the Agency may order the taking of appropriate corrective measures, or the payment of compensation for any expense incurred by a disabled person arising out of the undue obstacle, or both.

On June 18, 1992, an omnibus Bill (C-78) was passed by Parliament. It amended six Acts, including section 3 of the NTA, 1987. The words "accessible" and "persons with disabilities" were added to the introductory statement of section 3, which is the key statement of general policy in the Act. The statement now reads as follows:

> It is hereby declared that a safe, economic, efficient, and adequate network of viable and effective transportation services accessible to persons with disabilities . . . is essential to serve the transportation needs of shippers and travellers, including persons with disabilities. . . . [addition underlined]

## 1.2 THE *CANADIAN CHARTER OF RIGHTS AND FREEDOMS* AND THE *CANADIAN HUMAN RIGHTS ACT*

Section 63.2 of the NTA, 1987, directs the National Transportation Agency to coordinate its efforts on behalf of persons with disabilities with the efforts of the Canadian Human Rights Commission. In questions relating to persons with disabilities, the judicial system, including the Canadian Human Rights Commission, is influenced by the equity provisions of the *Canadian Charter of Rights and Freedoms*[2] and the *Canadian Human Rights Act*.[3] The key section of the Charter reads:

> *Equality Rights*
>
> 15.(1) Every individual is equal before and under the law and has the right to the equal protection and equal benefit of the law without discrimination and, in particular, without discrimination based on race, national or ethnic origin, colour, religion, sex, age or mental or physical disability.
>
> (2) Subsection (1) does not preclude any law, program or activity that has as its object the amelioration of conditions of disadvantaged individuals or groups including those that are disadvantaged because of race, national or ethnic origin, colour, religion, sex, age or mental or physical disability.

The key sections of the *Canadian Human Rights Act* stipulate:

> *General*
>
> 3.(1) For all purposes of this Act, race, national or ethnic origin, colour, religion, age, sex, marital status, family status, disability and conviction for which a pardon has been granted are prohibited grounds of discrimination.
>
> (2) Where the ground of discrimination is pregnancy or child-birth, the discrimination shall be deemed to be on the ground of sex.

*Discriminatory Practices*

5. It is a discriminatory practice in the provision of goods, services, facilities or accommodation customarily available to the general public

   (a) to deny, or to deny access to, any such good, service, facility or accommodation to any individual, or

   (b) to differentiate adversely in relation to any individual,

   on a prohibited ground of discrimination.

### 1.3 HOW THE SYSTEM WORKS

Although subsection 63.3(1) of the NTA, 1987 gives the National Transportation Agency the power to initiate inquiries into matters that relate to a regulation or a potential regulation, until recently the Agency normally limited its activities to the investigation of possible undue obstacles. In these cases, an individual had to have experienced an unsatisfactory situation before registering a complaint.

Under the *Canadian Charter of Rights and Freedoms* and the *Canadian Human Rights Act*, a traveller with a disability must have attempted to travel and been denied access in order to have a case. As pointed out in Chapter 9 of Volume 1 of this report, it is not sufficient to know that one would be refused access to a mode of transportation — a person must have been denied access before having recourse to the Canadian Human Rights Commission.

## 2. NATIONAL TRANSPORTATION AGENCY ORDERS AND REGULATIONS

This section outlines the key initiatives undertaken by the National Transportation Agency to improve the accessibility of transportation for people with disabilities. Since the NTA, 1987 was amended in July 1988, the Agency has resolved over 50 complaints about possible undue obstacles and has initiated four inquiries.

## 2.1 ORDERS AND DECISIONS

In response to complaints lodged with the National Transportation Agency, the Agency issued several orders and decisions to improve accessibility. For example:

- Canadian Partner (Ontario Express Ltd.) was ordered to reverse its policy of refusing to carry certain persons with disabilities on small aircraft (September 1990).
- Air Canada was instructed to make wheelchairs available on all aircraft that are equipped to store them and to assist those people who require help in using the nearest on-board washroom (July 1991).
- McIntosh Limousine Service at Lester B. Pearson International Airport in Toronto was ordered to provide transportation to all passengers with disabilities and to inform all of its drivers of this policy (August 1991).
- In June 1991, Air Canada and Canadian Airlines International were ordered to provide a reasonable number of copies of their safety briefing material in both braille and large print, in addition to the personal safety briefing provided to passengers with visual disabilities, effective August 1, 1992. The carriers were further required to show why they should not also provide safety information on audio cassettes. The Agency accepted the carriers' arguments that it is not operationally possible to provide such information on audio cassettes at this time.

## 2.2 REGULATIONS

On March 21, 1992, the National Transportation Agency published proposed regulations regarding transportation access for persons with disabilities in the *Canada Gazette, Part I*. The final regulations are proposed to become effective one year after they have been published in the *Canada Gazette, Part II.* As of July 31, 1992, they had not been published in Part II. The proposed regulations comprise two components:

- amendments to the *Air Transportation Regulations* "to regulate the domestic carriage of persons with disabilities in aircraft of 30 or more passenger seats relating to services to be provided to persons with disabilities;" and
- Personnel Training Regulations for the Assistance of Disabled Persons, which would apply to personnel in the transportation network governed by the *National Transportation Act, 1987* (all domestic air, rail, marine passenger carriers and Newfoundland's Roadcruiser bus service).

### 2.2.1 *Air Transportation Regulations* — Amendment

The proposed amendments to the *Air Transportation Regulations* specify, step by step, the kinds of assistance that must be provided to travellers with disabilities from the time they register at the check-in counter until they enter the general public area after retrieving checked baggage. The amendments also specify the way to handle special aids, such as wheelchairs, that are required for the mobility and well-being of a traveller.

Although these regulations in general apply to aircraft with 30 or more passenger seats, if an aircraft has fewer than 60 passenger seats, and its design prevents carrying an electric or manually operated wheelchair or three-wheel scooter, the air carrier is not required to carry the special aid. The air carrier, however, must advise the traveller about transportation arrangements that are available for the aid.

Where there is a conflict between the proposed regulations and any safety regulations made under the *Aeronautics Act*, the latter prevail.

The description of the proposed regulations indicates that they address areas agreed upon by organizations representing people with disabilities and air carriers. An important feature of the regulations is the guarantee of uniformity of services throughout the country for travellers with disabilities.

The description also acknowledges that the largest impact upon carriers will be on the small and medium-sized operators (about 25 in Canada) that will need to establish comprehensive programs for responding to people with disabilities. The regulations, however, do not require alterations to transportation equipment. Because the amendments apply only to procedures, the description states that "it is not anticipated that carriers will incur additional operating expenses."

The National Transportation Agency also noted in its general description of the regulations that the original set of proposals sent to interested parties in July 1988 "also referred to special air fares for the assistants of passengers with disabilities, and for additional seats required to accommodate a disability. The section on special air fares has been removed to permit further consultation."

In Chapter 9 of Volume 1 of this report, the Royal Commission recommends that:

> When the National Transportation Agency or the carrier concludes that, for safety reasons, an attendant is needed during a trip to assist an individual with a disability, the attendant's fare be borne by the carrier. Otherwise, the traveller should bear the cost. To ensure consistency, carriers should coordinate their policies in this area.
> (Recommendation 9.8)

Section 154 of the Agency's proposed regulations states that "an air carrier shall accept the determination made by or on behalf of a person that the person does not require any extraordinary service during a flight." "Extraordinary service" is defined as "any service related to a disability that is not required by [the proposed regulations] to be provided by an air carrier or any service that is not normally provided by an air carrier."

### 2.2.2 Personnel Training Regulations

This set of regulations applies to personnel employed by carriers in all modes of transportation and by owners, operators and lessees of passenger transportation networks governed by the Act, every operator of a terminal, including personnel, and agents who provide transportation-related services such as security, parking, car rentals, baggage handling and, in the case of air travel, ground transportation from the terminals. Exempt from the regulations are small air carriers whose gross annual revenues are less than $250,000 or whose operations are limited solely to serving the needs of a lodge operation, and owners, operators or lessees of air terminals where less than 10,000 passengers were enplaned and deplaned during the preceding year.

The definition of "carrier" used in the proposed regulations restricts the application of the regulations to Canadian citizens or permanent residents and governments in Canada or their agents. It also applies to any entity that is controlled in fact by Canadians having at least 75 percent of the voting interests, and that operates a passenger transportation service within and from Canada.

As with the amendments to the *Air Transportation Regulations*, the Agency is aiming for uniform training standards across the country so travellers with disabilities will know what to expect during any Canadian trip. Essentially, the training of carrier personnel is to be at a level appropriate for the requirements of their jobs and should emphasize:

(a) knowledge of the policies and procedures of the carrier and operator with respect to a person with a disability, including relevant regulatory requirements;

(b) recognizing those disabilities most likely to need special services, and knowing the responsibilities on the part of the carrier and operator in relation to those disabilities, such as the level of assistance, methods of communication, and aids or devices generally required by a person with a disability; and

(c) acquiring the necessary skills to assist a person with a disability, by knowing the role of the assistant as well as the needs of a person travelling with a service-animal, including the role and the needs of that animal.

In addition, applicable carrier personnel are to be trained in the areas of providing physical assistance to passengers with disabilities and handling mobility aids (including disassembling and assembling) and special equipment.

Carriers and terminal operators are required to file a description of their training programs, in a form set out in the schedule included in the regulations. This description must be filed with the Agency when the regulations come into force, that is, one year after their publication in Part II of the *Canada Gazette*.

Because the Agency's proposed training regulations are not yet in effect, the Royal Commission recommends in Chapter 9 of Volume 1 that:

> Carriers ensure that personnel who are in a position to assist travellers with disabilities be trained to deal with such passengers with sensitivity and understanding.
> (Recommendation 9.9)

## 2.3 OTHER PROPOSED REGULATORY INITIATIVES OF THE AGENCY[4]

### 2.3.1 Special Air Fare Policy

At the same time that the Agency prepared the proposed revisions to the *Air Transportation Regulations* discussed earlier, it also developed a special air fare policy. The regulations relating to this policy for aircraft with 30 or more seats have been separated from the other air regulations, and additional consultations are being held with the Air Transport Association of Canada, and with groups representing people with disabilities. It should be noted, however, that in approving draft regulations the Agency has determined that it is an undue obstacle to the mobility of people with disabilities to charge for the seat used by an attendant needed to provide services additional to those provided by the carrier, or to charge for additional seating that is needed to accommodate the passenger because of a disability. The current expectation is that the proposed regulations on special fares will be submitted to the Minister of Transport in autumn 1992.

### 2.3.2 Terms and Conditions of Carriage in Small Aircraft

Agency staff is currently completing an inquiry report into the manner in which carriers operating small aircraft serve people with disabilities. The report is expected to make recommendations on proposed regulations and will be provided to the industry for comment. The regulations will be for small aircraft (under 30 seats) and will cover services, fares for attendants, and fares for additional seats required to accommodate a passenger because of a disability. The Agency is expected to submit the regulations to the Minister early in 1993.

### 2.3.3 Terms and Conditions of Carriage in Other Federal Modes of Transportation

These proposed regulations will standardize the services provided to passengers with disabilities in modes of transportation (other than air) that are under federal jurisdiction. The proposals are being developed in consultation with an advisory committee representing people with disabilities, industry and federal government departments, including Transport Canada. The regulations are expected to be submitted to the Minister late in 1992.

### 2.3.4 Multimodal Equipment Accessibility

The proposed regulations will cover accessibility features in transportation equipment for all modes of transportation under federal jurisdiction. As for regulations concerning the terms and conditions of carriage, these proposals are being developed in consultation with an advisory committee representing all of the relevant parties. Two inquiries — one on ferries, the other on extra-provincial motor coaches — are currently under way and their results will be taken into consideration in the redrafting of the equipment standards. When these standards are amended, they will be distributed to the advisory committee members for comment before being submitted for Agency approval. The proposed regulations (with the exception of ones dealing with extra-provincial motor coaches) will be submitted to the Minister of Transport at the end of 1992.

### 2.3.5 Communication of Information to People with Disabilities

This initiative is expected to standardize, in all transportation modes under federal jurisdiction, the way information is provided to people with sensory or cognitive impairments. Agency personnel are currently developing draft regulations for consideration within the Agency. It is expected that these will be submitted to the Minister of Transport during the summer of 1993.

### 2.3.6 Accessibility of Transportation Facilities (Terminals)

Agency staff are currently considering draft standards developed by Transport Canada, as well as the Canadian Standards Association Barrier-Free Design Standards, to determine how they can be incorporated into a regulatory proposal covering terminals in all modes under federal jurisdiction. It is expected that the proposal will be submitted to the Minister of Transport during the fall of 1993.

## 3. MAJOR EVENTS, STUDIES AND INQUIRIES

The following section presents further details on major developments relating to transportation accessibility.

### 3.1 INDEPENDENCE '92

This major international conference was held in Vancouver from April 22 to 25, 1992. Its theme was "Self-Determination by Persons with Disabilities." The conference included an exposition whose centrepiece was "Independence Street," featuring an accessible bus as well as buildings and sidewalks that were designed to be very accessible. The conference concluded the United Nations Decade of Disabled Persons, giving people with disabilities and their representatives the opportunity to celebrate the accomplishments of the past decade and prepare for future initiatives.

## 3.2 CANADA COACH LINES DEMONSTRATION PROJECT[5]

A major demonstration project of accessible intercity busing commenced in October 1989 in the Kitchener to Niagara Falls corridor in Ontario. Although some experience in providing intercity accessible bus transportation had been gained in Newfoundland since 1985, an additional demonstration project was required to assess the demand for accessible intercity bus service and to collect information concerning the economics of such a service.

Canada Coach Lines (CCL) was the only bus company that expressed an interest in offering such a service and, therefore, was awarded a contract by Transport Canada for the demonstration project.

The service is scheduled to continue for three years. It operates in a 180-kilometre corridor from Kitchener to Cambridge, Hamilton, St. Catharines and Niagara Falls serving a population of approximately 900,000. Within this corridor, more than 13,600 people with disabilities had registered to use the local para-transit service. These registrants made up the minimum potential market for the demonstration project.

All scheduled services within the corridor are provided by accessible buses that have the capacity to carry two passengers in wheelchairs. Although not a requirement, passengers are encouraged to reserve their trips in advance to ensure that space is available. Reservations can be made from anywhere in the corridor by means of a toll-free number.

### 3.2.1 Key Results of the First 21 Months

*Users:* When surveyed, travellers with disabilities who used the intercity bus expressed a high level of satisfaction with the service. All users stated that they would continue to use the service. Two thirds said that they had taken more intercity trips because the service was available and a quarter said that they would not have travelled otherwise.

The total usage of the service, however, was very low. During the first 21 months, only 242 trips were made by people with disabilities, an average 12 trips per month. Only 41 people used the service, and two of these made 47 percent of all the trips. Thus, only about 0.3 percent of the potential market took advantage of the service, and the trips made by people with disabilities represented only approximately 0.04 percent of the total trips taken.

*Operations:* The accessible service has had little effect on CCL's operations. Because the number of disabled travellers has been relatively low, the additional effort required to book reservations and to coordinate transfers and other activities has not placed a significant burden on the operations staff. During the first 21 months, there were only 13 incidents that affected the operation of the service and none of these was major.

*CCL Personnel:* Canada Coach Lines developed a one-day training program for the personnel who would be serving passengers with disabilities. In a September 1990 survey of drivers and dispatchers, 90 percent stated that they believed they had been adequately trained. Four drivers indicated that they had experienced some difficulty in understanding some passengers' speech, which might suggest that future training should include techniques for dealing with the problem.

*Vehicles:* During the first 21 months, the lifts on the buses malfunctioned 26 times — resulting in minor delays, but all passengers were carried safely. It was found that the accessible buses require a higher level of maintenance than similar non-accessible buses. This is due mainly to the specialized equipment, especially the lift, as well as to increased brake wear, apparently caused by the weight of the lift and additional equipment. During the first year of the demonstration, maintenance costs averaged 7 cents per kilometre for the accessible coaches, compared with 2.5 cents for the non-accessible coaches. However, maintenance costs were highest during the first six months and have since decreased.

*Marketing:* When the demonstration project was initiated, major promotional efforts were made to inform potential customers of the existence of the service. Despite these activities, the service has not achieved a high level of market penetration. Brochures distributed through consumer organizations and local para-transit services appear to be the most effective way to inform potential users about the service.

*Financial Data:* During the first 21 months, the total cost of the demonstration was $338,800, of which $240,000 came from Transport Canada, $1,250 came from travellers with disabilities, and the remainder from Canada Coach Lines. Transport Canada paid for the lifts, the Washington transfer chairs and a portion of the marketing costs. CCL covered the toll-free telephone line, the personnel training costs, maintenance, and a portion of the marketing costs.

### 3.2.2 Supplementary Comments

In their submissions to the Royal Commission, some groups representing people with disabilities criticized the choice of location for the demonstration project, suggesting that Toronto should have been included. While use by people with disabilities has not been very high, Transport Canada has indicated that the route used for the demonstration is fairly representative of many routes in Canada. In addition, Canada Coach Lines is not licensed to operate into or out of Toronto.

## 3.3 INTERIM REPORT OF THE INQUIRY INTO LEVEL OF ACCESSIBILITY OF FERRY SERVICES

On March 19, 1991, the National Transportation Agency appointed three of its officers to "inquire into . . . whether the equipment and services offered by ferry companies under federal jurisdiction constitute undue obstacles to the mobility of persons with disabilities and make recommendations for the removal of such undue obstacles as they may discover."[6] These officers contacted major associations of, and for, people with disabilities, ferry operators, and provincial and federal governments. They met with representatives of many of these organizations and inquired into difficulties in gaining access to the vessels, accessibility to services on vessels, the awareness and training of ferry personnel, aspects of carriers' fare policies governing travellers with disabilities and the costs of providing accessibility. The inquiry officers also made their own examinations of some frequently used services.

Among the ferry services visited were BC Ferries (Canada's largest ferry operator but provincially regulated since it operates within British Columbia), Marine Atlantic Inc., Northumberland Ferries Limited, Société des traversiers du Québec and Coopérative de transport maritime et aérien (CTMA). The inquiry team also held discussions with providers of provincial services in Newfoundland and British Columbia.

The inquiry reached the following conclusions[7] in its interim report dated January 17, 1992:

1. Overall, carriers are making efforts to improve accessibility; Marine Atlantic especially is making efforts and in doing so benefits from its on-going consultations with an Advisory Accessibility Committee.

2. There are no national standards across Canada and the inquiry officers believe that inconsistencies in levels of accessibility pose obstacles to the mobility of persons with disabilities.

3. Since Northumberland Ferries Ltd. is reliant upon the federal government, through Transport Canada, for its operations, the inquiry officers believe that its operations should reflect the policy of the federal government. Transport Canada is a participating Department in the National Strategy for the Integration of Persons with Disabilities, whose purpose is to encourage industry to develop and use equipment that will advance accessibility of transportation.

The inquiry's interim report was circulated to interested parties, and comments were received and analyzed. The Agency has noted the findings in their Final Report, which will also be distributed to interested parties. That part of the report dealing with proposed regulations will be incorporated into the Agency's regulation development program.

## 3.4 INQUIRY INTO CANADIAN MOTOR COACH SERVICES

This inquiry, entitled "The Road to Accessibility," is examining the level and adequacy of accessible services currently available on extra-provincial motor coaches. The inquiry is also to determine if it is appropriate to set a national standard for services, and the financial implications of doing this. Public hearings are being conducted throughout the country and it is expected that a report will be presented to the Minister of Transport early in 1993.

## 3.5 INQUIRY INTO GROUND SERVICES AT AIRPORTS

In response to a request from the Canadian Paraplegic Association, the Agency is inquiring into whether the equipment and services offered by automobile rental agencies, taxis, limousines and airport shuttle buses operating at or from Canadian airports present undue obstacles to the mobility of people with disabilities. At the time of writing, it is expected that the inquiry will be completed in the summer of 1992.

### 3.6 INQUIRY INTO THE POLICIES OF CANADIAN AIR CARRIERS

This inquiry into the policies, standards and practices of all Canadian air carriers with respect to transporting people with disabilities was conducted in two parts. The first part dealt with operators of large aircraft (30 seats or more) and has been circulated to interested parties; the second dealt with the accessibility of smaller aircraft (fewer than 30 seats) and should be circulated to interested parties in late 1992.

## 4. A CANADA–UNITED STATES COMPARISON

Chapter 9 of Volume 1 describes the frustration and progress that has occurred in relation to access to transportation for people with disabilities. It specifically mentions the *Americans with Disabilities Act of 1990,* a major event in the United States. This section describes the U.S. legislation and compares it with the situation in Canada.

Canada has not been alone in becoming more aware of the needs of people with disabilities. As is noted in Volume 1, Chapter 9, there has been frustration in Canada at the lack of progress in addressing these needs, including increasing access to transportation services. On the other hand, there has been progress in all passenger modes and it would be inaccurate to underrate the importance of the improvements that have occurred. The bus mode appears to have improved most slowly and, therefore, it is especially positive that the National Transportation Agency embarked on a major inquiry into accessibility within this mode.

In Canada, progress toward increased accessibility has been uneven. This is also the case in other countries that the Royal Commission examined. The example of the United States has been of particular interest to Canadian organizations of and for persons with disabilities, because of the passage of the *Americans with Disabilities Act of 1990,* which applies to the rail and bus modes, and the *Code of Federal Regulations* pursuant to the *Air Carrier Access Act of 1986,* which applies to the air mode. Some Canadian organizations would argue that this legislation places the United States well ahead of Canada in its treatment of people with disabilities. The provisions in the Code and the Act are very comprehensive. In addition, the Act provides for new regulations regarding standards to be met. The following provides a summary of some of the major provisions.

## 4.1 AIR MODE

The *Code of Federal Regulations* puts into practice the *Air Carrier Access Act of 1986*, which states that, when providing air transportation, no air carrier may discriminate against any otherwise qualified person because of a disability.

The Act and the Regulations specify in considerable detail how aircraft and their interiors must be configured to make seats and washrooms accessible; how airport facilities should be designed; when an air carrier is required to provide transportation to a person with a disability and to provide the services that make the trip feasible (such as oxygen); how aircraft boarding and seat selection are to be performed; when and how personal equipment such as wheelchairs and other aids are to be stowed; how information must be provided to travellers with disabilities; and what special services must be available to people with hearing impairments.

The key provisions on arrangements for attendants accompanying travellers with disabilities are as follows:

- A carrier may require that an attendant accompany a person with a disability in specific circumstances for the safety of the passenger (for example, if a mental disability or severe hearing and sight disabilities prevent the passenger from understanding the safety briefing).
- If the carrier determines that a passenger must travel with an attendant, but the passenger believes that he or she is capable of travelling independently, the carrier shall not charge for transporting the attendant.

- If the carrier determines that an attendant is necessary but an extra seat is not available on the flight on which the traveller has a confirmed reservation, then the traveller with the disability shall be eligible for denied-boarding compensation.

As described earlier in Section 2 of these Notes, the National Transportation Agency has proposed regulations regarding accessible transportation, which will become effective one year after the date of their publication in the *Canada Gazette, Part II.* At the time of writing, the publication in Part II had not occurred. One important consideration to organizations of, and for, persons with disabilities relates to fares for attendants. This issue has not been covered in the regulations the Agency has promulgated to date. The Royal Commission's recommendation concerning attendants is similar to the U.S. requirement already in place.

In the United States, if the physical limitations of an aircraft with less than 30 passenger seats preclude the use of existing models of lifts, boarding chairs or other feasible devices to enplane a person with a disability, air-carrier personnel are not required to carry that person onto the aircraft by hand. In Canada, the currently proposed amendments to the regulations do not pertain to aircraft with fewer than 30 seats. Consequently, there are no regulations available at present to compare with those in the United States. A specific National Transportation Agency decision, however, suggests a direction for the Canadian situation. For example, the Agency ordered Canadian Partner (Ontario Express Ltd.) to make its transportation system accessible to persons with disabilities. This case involved a Jetstream 31 aircraft, which has 19 seats. In response, Canadian Partner is exploring, with manufacturers, the development of a device that will allow access to aircraft in a dignified manner by passengers requiring assistance. However, until a suitable device is available, passengers requiring assistance in ascending and descending stairs on the Jetstream 31 will be manually lifted by Canadian Partner crew. Training in various lifting techniques will be provided to the personnel involved.

In Canada, as described earlier, the National Transportation Agency has proposed regulations for domestic air carriers using aircraft with 30 or more seats. At the present time, Air Canada and Canadian Airlines International each have various special services, not currently required by regulation, to assist travellers with disabilities. These special services are similar to some of the provisions found in the *Code of Federal Regulations* for U.S. air carriers and include:

- advance seat selection;
- a toll-free line available in Canada for those with a Telecommunications Device for the Deaf (TDD);
- reduced fares for attendants on flights within North America;[8]
- transportation of wheelchairs free of charge in the cargo compartment and the provision of special packing for wet-cell battery packs used on motorized chairs;
- for in-flight use, airline-provided wheelchairs on all airplanes except DC-9s and Boeing 747 combis (Air Canada) and Boeing 737s and DC-10s (Canadian Airlines International);
- on all Boeing 727s, 767s and 747s (Canadian Airlines International only for the latter), Airbus A310s and A320s, and DC-10s,[9] washrooms that are accessible to passengers in wheelchairs;
- on all aircraft, except Air Canada's Boeing 747 combis and some 727s, retractable arm rests on selected aisle seats to ease the transfer of travellers from wheelchairs to their seats;
- oxygen "Medipaks," for passengers with respiratory problems, available at an extra charge with advance notice (72 hours for Air Canada and 24 hours for Canadian Airlines International);
- provision for guide dogs accompanying passengers with a visual or hearing impairment in the passenger cabin, except on flights to the United Kingdom and New Zealand, due to animal quarantine regulations in those countries;

- a variety of specially prepared meals when advised 24 hours in advance;
- individual on-board safety briefings; and
- a special facility at Lester B. Pearson International Airport with full-time airline staff offering assistance to passengers needing boarding assistance (Air Canada at Terminal 2 and Canadian Airlines International at Terminal 3).

## 4.2 SURFACE MODES

The *Americans with Disabilities Act of 1990* provides the criteria to determine if discrimination under the Act has occurred in providing transportation services to people with disabilities. Separate criteria are set out for:

- public entities such as bus, rail, or any other conveyance (other than aircraft or intercity or commuter rail) that provide the general public with general or special service (including charter service) on a regular and continuing system;
- operators of commuter rail transportation and intercity rail transportation (the latter being Amtrak); and
- private entities offering travel or transportation services. (These services include transportation by bus, rail, or any other conveyance, other than by aircraft, that provides the general public with service, including charter, on a regular and continuing basis.)

For the most part, there are differences between new and existing equipment and facilities. Generally speaking, new equipment must be accessible to travellers with disabilities. Private entities, however, operating purchased or leased vehicles with a seating capacity of fewer than 16 passengers face more relaxed requirements. Existing equipment and facilities must be fully accessible by specified deadlines.

One controversial area relating to the application of the Act and Regulations concerns over-the-road buses.[10] To deal with these issues, the Office of Technology Assessment has undertaken a study to determine:

- the access needs of individuals with disabilities to over-the-road buses and over-the-road bus service; and
- through consideration of all forms of boarding options, the most cost-effective methods for providing access to over-the-road buses and over-the-road bus service to individuals with disabilities, particularly individuals who use wheelchairs.

The study, including any options for legislative action, is to be submitted to the President and Congress by July 1993.

In Canada, for the surface modes, the major event related to accessibility is the proposed National Transportation Agency regulations relating to the training of carrier personnel to assist travellers with disabilities. As mentioned earlier in these Notes to Chapter 9, the Agency is in the process of preparing regulations concerning the terms and conditions for transporting persons with disabilities using federally regulated modes other than air (which has already received some attention). Regulations covering the accessibility features of transportation equipment in all modes of transportation under federal jurisdiction are also being prepared, as are regulations to standardize the communication of information to persons with sensory or cognitive impairments.

# ENDNOTES

1. *National Transportation Act, 1987.* R.S.C. 1985, c.28 (3rd Supp.).

2. *Canadian Charter of Rights and Freedoms.* R.S.C. 1985, Appendix II, No. 44.

3. *Canadian Human Rights Act.* R.S.C. 1985, c.H-6 (2nd Supplement).

4. National Transportation Agency of Canada, *Accessible Transportation Services for Persons with Disabilities.* A Staff Report to the National Transportation Act Review Commission, May 1992.

5. *Canada Coach Lines Accessible Intercity Bus Service Demonstration, Preliminary Results* prepared by Transport Canada, Policy and Coordination, Transportation Development Centre, October 1991. Information on the total ridership, potential market of persons with disabilities and allocation of costs between Transport Canada and Canada Coach Lines was obtained from Transport Canada officials.

6. Kenneth A. Mozersky, Anne M. Hampel and Paul Lacoste, *Interim Report of the Inquiry into Level of Accessibility of Ferry Services* (Ottawa: National Transportation Agency of Canada, January 17, 1992.)

7. Ibid., p. 12.

8. The attendant's fare is 50 percent of the applicable fare (whether full or discount) at the time.

9. The DC-10 washrooms could be considered "not fully" accessible since the door to the washroom cannot be closed. Entry to the washroom is facilitated by a bar and a privacy screen, and the latter conceals the Washington chair and doorway while the washroom is in use. Canadian Airlines International, however, is phasing out its DC-10 aircraft.

10. An "over-the-road" bus is defined in the United States as one that has an elevated passenger deck located over a baggage compartment.

# NOTES TO CHAPTER 18:
# CHANGES IN COSTS TO 2000 S-Q AND 2000 D CASES – METHODOLOGY AND ESTIMATES

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# INTRODUCTION

Chapter 18 of Volume 1 describes the changes in costs by mode to be expected during the decade from 1991 to 2000 under *Status Quo* (S-Q) and *Directions* (D) conditions. The chapter describes the changes forecast using four trips as illustrations:

- Saskatoon to Halifax
- Toronto to Montreal
- Winnipeg to Churchill
- Halifax to St. John's

Subsequently, the system-wide changes to be expected in each mode are summarized when the total estimated costs for 2000 S-Q and 2000 D are presented in Tables 18-5 and 18-6 of Volume 1.

These notes will reverse this order, describing first the system-wide changes to be expected in each mode, and then offering some details for each of the sample trips where these differ from the system-average changes.

In general, the percentages of change cited here for various factors that differ from 1991 to 2000 S-Q, or between 2000 S-Q and 2000 D, are used in developing our illustrative estimates. They do not always match percentage changes that can be calculated from the tables in Chapter 18. The percentage changes implicit in those tables may differ because rounded numbers and sums of rounded numbers were used in the tables.

# 1. CHANGES EXPECTED FROM 1991 TO 2000 S-Q

## 1.1 CHANGES IN TRAFFIC BY MODE

Simple assumptions are made that, in the absence of the policy changes recommended by the Royal Commission, intercity traffic by mode in passenger-kilometres would grow between 1991 and 2000 by:

| | |
|---|---|
| • Car | 30% |
| • Bus | no change |
| • Airplane (domestic) | 30% |
| • Train | no change |
| • Ferry | 30% |

These are not intended to be accurate forecasts, but merely illustrative of the possibilities, in order to allow the implications of the Royal Commission's recommendations to be explored. Their realism can be judged in light of the following observations about recent changes in traffic by mode:

- On Ontario highways, traffic increased between 1980 and 1989 by 36% measured in vehicle-kilometres by all classes of vehicle (separate estimates for car traffic being unavailable).[1]
- Passenger-kilometres on intercity buses are not available, but between 1980 and 1989, total bus-kilometres on intercity unit toll services fell by 16%, while total passengers carried fell by 47%.[2] It is noted, however, that part of the decline is attributable to the reclassification of GO Transit bus services from intercity to urban transit.
- Passenger-kilometres on domestic unit-toll air carrier services increased by 13% between 1981 and 1990, and by 32% between 1983 and 1990.[3]

- Revenue passenger-kilometres on intercity train services declined 3% between 1980 and 1989, and then, on VIA Rail services (87% of the 1989 total), almost halved in 1990.[4]
- The number of passengers carried on intercity ferries increased between 1980 and 1988 by 39% (46% on west coast ferries and 10.5% on east coast ferries).[5]

## 1.2 CHANGES IN COSTS BY MODE BETWEEN 1991 AND 2000 S-Q

### 1.2.1 Car

The 2000 S-Q case differs from the 1991 case in allowing for some improvements in vehicle fuel consumption, emissions and safety. Fuel efficiency and $CO_2$ emissions are expected by Environment Canada and the National Energy Board to improve by about 13% per vehicle (fleet average) by the year 2000.[6] In the cost estimates, the fuel component of vehicle/carrier costs is therefore reduced by 13% in 2000 S-Q, and the $CO_2$ component of environmental damage costs is reduced by 13%.

The Canadian Council of Ministers of the Environment, through adoption of its Management Plan, intends that $NO_x$ and VOCs emissions will fall by about 40%, including the effects of announced vehicle emission standards and a number of specific programs in the "ozone-sensitive areas."[7] The $NO_x$/VOCs component of environmental damage costs is therefore reduced by 40% in 2000 S-Q.

Safety is predicted to continue to improve in terms of fatality rates per vehicle and per passenger-kilometre; recent trends have been strongly downward, but the longer term reduction is somewhat slower. On the other hand, the frequency of less-severe accidents and their damage costs continue to increase. An expectation that the reduction in deaths will predominate in the cost equations is represented by a reduction of 10% in the cost per passenger-kilometre.

The fuel tax component of special taxes/fees is assumed to be unchanged per passenger-kilometre, despite the reduction in fuel consumption noted earlier. It is expected in the status quo option that governments would adjust tax rates upward to offset reductions in tax revenue per passenger-kilometre (their practice over the last 15 years having been to increase tax rates more than needed to offset reductions in fuel consumption per vehicle-kilometre).

Together, these changes would reduce average car costs per passenger-kilometre by about 4% by the year 2000.

### 1.2.2 Bus

The illustrative figures for the bus mode, projected to 2000 but presuming no change from the present regime of provincially regulated regional monopolies, reflect an expectation that, without major policy change, there will be little improvement in costs in this mode. Only the cost of accidents is projected to fall by 10% per vehicle-kilometre and per passenger-kilometre compared with 1991 — reflecting a continuing trend toward safer travel by improving vehicle technology and improving infrastructure and control systems.

This portrayal of 2000 S-Q bus costs could prove optimistic if the current decline in the use of this mode continues; however, for the system total and for the sample routes selected, continued deterioration has not been assumed.

### 1.2.3 Airplane

The carrier component of air travel costs is expected to continue to fall through 2000 as the older aircraft of existing fleets are replaced by newer airplanes that are fuel efficient, require fewer people in the flight crews, and have lower maintenance costs. New aircraft will reduce the cost of most Canadian domestic air operations. Aging DC-9s, Boeing 727s and early models of the B-737 are being replaced by a new generation of aircraft. These are quieter, can be operated by a cockpit crew of two (instead of three), and are much more economical on fuel.[8]

In some instances, the newer aircraft can accommodate twice the passenger load at the same fuel consumption. For airplanes, such as the Airbus A320 (which is replacing the B-727-200), the same number of passengers are transported at a 40% fuel saving (approximately 150 people in the "all-economy" configuration). A reliable picture of the maintenance costs for the newer aircraft will have to wait until they have aged, but substantial savings are indicated. The following estimated savings were developed using published U.S. airlines' data.[9]

| **SAVINGS: A320 over B-727-200** | |
|---|---|
| Crew | 10% |
| Fuel | 40% |
| Maintenance | 20% |

For illustrative purposes, and based on the above, the air operations cost models were projected to 2000 by adjusting fuel and labour costs. The aggregate effect was cost reductions, for system-average vehicle/carrier costs in the sample routes, of 11.5% to 13.5%. For the system average, the projected 1991 to 2000 cost reduction is approximately 12%. With cleaner engines and this fuel saving, an emissions reduction of 15% was estimated.

Air traffic has, with intermittent corrections, grown steadily over the years. It is reasonable to assume that such growth would generally continue. Transport Canada staff (from their Passenger Origin-Destination Model) provided Royal Commission staff with forecasts of air traffic origin-destination from 1989 to the year 2000.

The model forecasts indicate a growth in domestic airline traffic of 37% from 1989 to 2000. This amounts to approximately 30% for 1991 to 2000.

Although the traffic increase that is forecast would affect the economics of flying, particularly between lower density city pairs, it is not expected to have any important impact on the system-average load factors (presumed to be 67.5% for jet and 56% for commuter turboprop) used in the carrier cost presentation. On the other hand, the impact on the average unit cost for under-utilized airports would be considerable — presuming that traffic increases are not matched with even more investment.

Aviation infrastructure spending is expected to grow much less than traffic, indicating that costs per passenger-kilometre will fall. Costs at Toronto and Vancouver airports are the exceptions; it is assumed that expansion costs at these airports would preclude economies in per-passenger costs. Otherwise, marginal costs for Calgary, Edmonton, Winnipeg, Ottawa, Montreal and Halifax are assumed to be 50% of 1991 average levels, and at smaller airports, zero. Presuming a system-average growth in airport activity (domestic and international combined) of 42% from 1989 to 2000,[10] average airport costs per passenger-kilometre would fall by 17% at the six airports listed earlier, and by 30% at smaller airports.

Air navigation services costs per passenger-kilometre are projected to fall system-wide by an average of 25% by the year 2000. Total land costs remain unchanged, but are averaged over a 30% greater volume of passenger-kilometres. Average costs attributable to land, therefore, fall by about 23% per passenger-kilometre. Overall, infrastructure costs fall by about 22%.

Improvements in average fuel consumption (as mentioned earlier) will continue as older models of aircraft retire and are replaced by more efficient versions. An improvement of 15% between 1991 and 2000 is assumed, producing an equivalent reduction in $CO_2$ and air pollutant emissions damage. In addition, environmental costs are projected to fall as noise costs are presumed to halve, following more extensive adoption of "Stage III" aircraft.

Aircraft fuel tax per passenger-kilometre is projected to decline by 15%, in line with fuel consumption. For cars, where fuel taxes are the main source of government revenue, it is assumed that governments would adjust road fuel tax rates per litre upward to offset declining consumption. For air, no change in fuel tax rates is assumed. Had the assumption been the same as that made for cars, the difference in total costs in the 2000 S-Q case would have been relatively minor.

Airplane accident costs per passenger-kilometre are presumed unchanged.

In sum, domestic air travel costs per passenger-kilometre are projected to fall by about 15% from 1991 to 2000.

### 1.2.4 Train

Improvements in VIA Rail's cost-recovery performance were generally projected, but assumed to be restricted to its higher potential services. For the sample routes considered, no changes in cost and revenue levels were assumed in cost levels prevailing for Winnipeg to Churchill, or the Montreal to Halifax segment of the hypothetical Saskatoon to Halifax rail journey. For the Saskatoon to Toronto link, a large improvement in average passenger revenue was projected — reflecting an increased emphasis on higher-quality and higher-priced, tourist-focussed transcontinental service. Also included are more-modest increases in per passenger infrastructure and train costs — allowance for the net effects of lower passenger-kilometres per car-kilometre, adjusted in the case of train costs for predicted operating economies.

Projected changes for the Toronto to Montreal sample route are more substantial — in keeping with VIA Rail's plans for a faster service using improved equipment, which will garner higher revenues. Per-passenger vehicle/carrier costs are projected to fall from $124 to $106, revenue to improve by $4 and infrastructure charges to increase (by $2) due to higher speeds.

No change is expected in environmental, accident or special tax/fee costs per passenger-kilometre. The projected reductions in vehicle/carrier costs are sufficient to reduce train costs per passenger-kilometre overall by about 4% between 1991 and 2000.

### 1.2.5 Ferry

No change is anticipated in the costs per passenger-kilometre of any of the ferry services. However, system-average vehicle/carrier costs would fall slightly as growth is expected to be more vigorous among the west coast services (40% growth in passenger-kilometres, compared with 10% on east coast services), and those west coast services have much lower costs per passenger-kilometre.

Overall, ferry costs per passenger-kilometre are projected to fall by about 3% between 1991 and 2000.

## 2. CHANGES EXPECTED FROM 2000 S-Q TO 2000 D

### 2.1 CAR

The year 2000 D case essentially involves:

- A large shift in the burden of the infrastructure costs from taxpayers to users;
- Introduction of payments by users for the environmental damage costs to users, offsetting costs borne by others; and
- A transfer to users of that portion of accident costs hitherto borne by others.

Accident cost changes are a simple transfer. We do not assume any further improvement, although the change in responsibility for cost might well be an incentive for improvement. The infrastructure cost changes and environmental cost changes are more complex, and will be described further.

The analysis of 1991 system-average costs suggested that, within car infrastructure costs, the costs of "control" were matched by registration fees, but the remaining costs of the "way" (including capital charges and land costs, as well as pavement wear and maintenance costs) were approximately double the revenues received by governments from special fuel taxes. Infrastructure cost recovery could be achieved by doubling the fuel tax rate. Implementing the Royal Commission's recommendations, however, should lead to the application of more rigorous criteria to expenditure decisions on the road network, slowing expansion relative to traffic growth.

To illustrate the possible consequences, infrastructure costs are assumed to be about 5% lower in the 2000 D case. Presuming that the fuel tax (the dominant element of the 2000 S-Q special transportation tax/fee) was the means of collecting the infrastructure charge, it would only need to be increased by about 90% to cover the comprehensive costs throughout the road network.

It is expected that, at least for the next decade or so, road infrastructure charges would be applied (through fuel taxes) at the same rate network-wide, rather than differing by link. The new average charges would therefore produce large surpluses over costs on the links with dense traffic, particularly expressway-standard highways. The surpluses would be needed to cross subsidize less-travelled routes that continued to under-recover. This is evident in the illustrations for sample routes, all of which (except Winnipeg to Churchill, which has no continuous road link) are on major highway routes, with sufficient road traffic to show surpluses on the new infrastructure charges in the 2000 D case.

The net cost increase to users under the 2000 D scenario from infrastructure, environmental and accident charges, less special taxes, would not add dramatically to fully allocated average costs per trip. As of 2000, it would constitute an 8% increment to the average cost per passenger-kilometre, or per trip. The increment would be, however, a larger portion of the "out-of-pocket" costs perceived by motorists, and would amount to a large percentage increase in the effective cost of fuel consumption. This might be expected to cause appreciable changes of travel behaviour and especially in the type of vehicle purchased. In the 2000 D illustrations, it is assumed that these reactions will produce another 10% reduction in both fuel consumption and emissions.

Overall, car costs per passenger-kilometre fall by about 2%. It should be noted, however, that demand for road travel will also be somewhat dampened through travelling less and switching modes, which is not represented in the tables.

## 2.2 BUS

Regulatory reform, to allow entry to the intercity scheduled bus industry on the basis of "fit, willing and able" criteria, would open the bus industry to competition, and give operators greater commercial freedom. This could induce cost efficiencies and the removal by carriers of internal cross subsidies among routes. Potential efficiencies are illustrated by a 15% reduction in vehicle-carrier costs of the bus services once carriers are free to adjust equipment, schedules and fares to the market, and to withdraw from services where patronage is insufficient.

The analysis of 1991 costs suggested that public infrastructure costs — the allocated costs of the road system, including capital charges and land costs—are almost balanced by the "special taxes/ fees" from buses. Infrastructure costs per bus-kilometre would fall very slightly (about 5%) along with the overall improvement in road infrastructure spending described in the section earlier on car costs. The new infrastructure charges per bus-kilometre would be introduced at levels only slightly higher than those taxes and fees that they replaced. Adjusting for the improvement in average load factor, infrastructure charges per passenger-kilometre would fall further.

User charges would also be instituted for environmental damage costs, transferring the costs from the general public to bus users. These environmental charges would induce bus fuel consumption improvements and emissions reductions, reinforcing reductions arising through more stringent regulations. The scope for additional improvement in bus emissions per vehicle-kilometre appears large relative to that for cars. Compounding this, with a load factor improvement projected for the 2000 D scenario, a reduction of 30% would be a reasonable expectation.

Overall, operating efficiencies and the removal of cross subsidies would mean that costs borne by users would fall by about 11%, even after imposition of the new user-charges. The average full cost of a passenger-kilometre of bus travel would fall by about 15% from the 2000 S-Q scenario.

Bus costs used for the route-specific illustrations are not estimates of actual costs for the routes in question. They are based on adjusting the system-average costs developed (see Notes to Chapter 3 in this volume) for factors specific to the route type. In some cases what they portray may not be accurate. For example, the costs illustrated in the 1991 and 2000 S-Q cases for Halifax to St. John's are not actual costs of the service provided by CN Roadcruiser, but generic costs for similar services provided privately elsewhere. The actual costs are probably substantially higher. For the Newfoundland service, the expectation is that privatization and/or contracting for operation of subsidized services might well reduce costs proportionally more than shown in Table 18-4, which is based on expected changes in system-average costs.

## 2.3 AIRPLANE

No further changes in air carrier unit costs, except for infrastructure and environmental charges, have been assumed to result from the 2000 D scenario.

Applying the disciplines of full cost recovery and user-sensitive management to airport and air traffic control investment and management should result in infrastructure cost reductions. Actual economies from eliminating excess costs would vary widely by site. Cost saving potential in airports is represented by a reduction of 10% in costs per passenger at Toronto and Vancouver airports, 25% at medium-sized airports, and 35% at smaller airports. Special circumstances are illustrated for the Winnipeg to Churchill example, discussed later.

The illustrative cost reduction presumed to be achieved from public utility style management of air navigation services is 25%. Improvement might well exceed that, as illustrated by the success of the Airways Corporation of New Zealand.[11] Infrastructure costs therefore fall by about 18% on average. Carriers and passengers would be charged directly for these infrastructure costs, but with the exception that the smaller airports[12] would retain transitional subsidies, estimated at $40 million in total in 2000.

The federal fuel excise tax would be eliminated, replaced by a charge for environmental damage. This would induce some additional reduction in aircraft emissions through improved technology or operating practices, illustrated as a reduction of 5% in environmental costs per passenger-kilometre.

Overall, air travel costs per passenger-kilometre fall by about 5% compared with 2000 S-Q. User costs per passenger-kilometre increase by about 10%.

### 2.4 TRAIN

Different effects of the 2000 D scenario on rail carrier and infrastructure cost, and consequent changes in service offerings, are illustrated for the Toronto to Montreal and Saskatoon to Halifax examples, and in subsection 2.6 for the Winnipeg to Churchill example.

The 2000 D scenario illustrates a possible niche for rail on the Toronto to Montreal route. One hypothetical niche could, of course, be a Toronto to Montreal high-speed rail system; however, even if a decision to proceed were taken on the completion of present studies, the system would not be operative until well after 2000. The niche for rail assumed under the 2000 S-Q scenario involves a system that is more expensive to the user — much more expensive. In part, this would be due directly to full commercial cost recovery. Also, with its prices rising, the only possible approach would seem to be for rail travel to seek a market by moving "up scale."

Part of the projected price rise to an average Toronto to Montreal fare of $119 by 2000 (still supplemented by a transition subsidy of $21) is attributable to improved speed, comfort and service. It is possible that travellers would be unwilling to pay 22 cents per kilometre (24 cents per kilometre standardized to air distance, rising to 28 cents over about three years as the VIA Rail subsidy completely disappeared in 2003), even for an improved rail service, and the mode would fail to survive in an open market. Such a rail operation would, however, provide a markedly improved service, and fill a niche closer to air travel than to bus travel. It would cost less than 75% (rising to 87% as transitional subsidies are phased out) of the price of air travel, be more comfortable, and require only marginally more — or in some cases less — travel time, depending on exact origins and destinations within the metropolitan regions. The time disadvantage of rail is further diminished if time spent less conveniently (that is, time in taxis or terminals) is weighted more heavily relative to time spent comfortably aboard the train or airplane.

Saskatoon to Halifax by rail would cost the user more than four times the air price, or $1,556 for a trip with three changes of trains and with average accommodation, when the transition process is complete early in the next century. (Declining subsidies would mean that the trip would cost $1,271, or more than three times the price of air, in 2000.) Anyone choosing such a trip at this cost would doubtless want better-than-average accommodation, and would have to pay substantially more. The system-total reduction of rail passenger-kilometres for the 2000 D scenario by half (to 0.7 billion passenger-kilometres) recognizes the likely major effect of increasing costs on rail patronage. Remaining rail service would probably be concentrated on higher-volume routes and some tourist services.

Because the potential for fuel consumption and emissions reductions appears large, especially as part of a process of concentrating services on higher-volume routes, it is illustrated by a 20% reduction in environmental damage costs per passenger-kilometre.

## 2.5 FERRY

Major changes would be introduced to ferry financing, through a phase-down of subsidies over a 10-year period. In the illustrative case it is assumed that, by 2000, this would apply even to the ferry services that are "constitutional" obligations, and that the subsidy would, by 2000, be only about one quarter of its 1991 level. This stimulus, together with the introduction of other management incentives to efficiency (including the ability to contract services in publicly owned ships, and the institution of an advisory panel of users on services and fares), would be expected to reduce costs. In the illustration, it is assumed that costs fall by 20% per passenger-kilometre on the east coast services and by 5% on west coast services (for which average costs per passenger-kilometre are already substantially lower).

Introducing direct charges for environmental damage would prompt reductions in fuel consumption and emissions of about 20%.

There is also scope for reduction in the average costs of the publicly provided infrastructure. Full cost recovery by Transport Canada, together with the creation of a users' advisory body on investments, services and charges, should stimulate efficiencies in provision of the services. This is represented in the illustration by a reduction of 10% in the infrastructure cost per passenger-kilometre.

In summary, costs to users per passenger-kilometre rise by about 40%, while overall comprehensive costs per passenger-kilometre fall by about 9%.

## 2.6 CHURCHILL TO WINNIPEG: AN ILLUSTRATION OF CHANGE

The town of Churchill has approximately 1,200 residents and no road access. Expenditures by "taxpayers" to maintain existing passenger transportation to and from Churchill are very large per trip, and relative to the total population of the area served. A $19.5-million passenger-rail subsidy in 1990 equalled over $16,000 per resident of Churchill; the airport subsidy amounted to another $8,000 — slightly less if the population served using Churchill Airport as an intermediate point is considered. These are large amounts relative to benefits to the residents. Under the 2000 D scenario, air and rail connections would still be provided but at much lower cost to taxpayers.

### 2.6.1 Air

Churchill Airport accounts for a total annual cost attributable to commercial aviation of $9,524,000. Of this, $3,951,000 and $1,368,000 would be required to cover airfield and terminal capital investments respectively. Operating costs, excluding depreciation but including Transport Canada overhead, were $4,234,000 in 1990-91. Thompson, Manitoba, however, has a lower comparable total annual cost (including cost of capital) and lower operating costs, of $2,832,000 and $977,000 respectively — and Thompson handles similar aircraft and three times the passenger traffic of Churchill. Other comparisons with airports handling similar commercial traffic also confirmed that Churchill is over-built for the commercial aviation traffic it handles.

Although some of the airport facilities might be justified on the basis of military use or other benefits, it would seem reasonable to run an airport at Churchill for about 100 to 150 passengers daily at an operating and maintenance cost of the order of $800,000 annually, or $23 per passenger. Under the 2000 D scenario this would occur.

Presuming that the over-building were written off, it remained to estimate necessary sustaining capital. Here, as will be the case with any specific site, the question of the necessity of providing a full-service jet facility arose; a facility for turboprop aircraft was presumed adequate, at an estimated (sustaining) capital charge of $500,000 annually. Thus, including the charge for using Winnipeg, a total airport cost per passenger of $37 would seem reasonable. To this is added $6 for air navigation services, for a total infrastructure cost of $43. The total is still a substantial increase over the $25 that the average passenger would pay under the 2000 S-Q scenario. For illustrative purposes, a transitional subsidy of $9 is shown, with the average passenger paying $34.

### 2.6.2 Rail

Table 18-3 in Volume 1 illustrates, for Churchill to Winnipeg travel, an important aspect of the Royal Commission's recommendations for rail in more remote circumstances — Recommendation 12.5b, that "any subsidized remote access service (regardless of mode) be designed to take passengers out to and bring them in from the closest convenient point where transfer can be made to a commercial unsubsidized carrier." Rail travel (the average of fares for upper and lower berths) from Winnipeg to Churchill presently costs the traveller $229, and would continue to do so under the 2000 S-Q scenario. This is insufficient even to cover the allocated $280 cost for the use of CN's track. Most of the total cost (including a $41 credit for the excess of attributable fuel taxes over the normal sales tax[13]) of $2,978 per passenger is paid by the taxpayer. No improvement in this cost recovery is predicted unless there is a major change in the service offered.

### 2.6.3 Intermodal

There is bus service to Gillam, 265 km to the south of Churchill. The illustrative table for 2000 D shows a bus-train service that would provide transportation to Churchill at a total cost of $179. A mixed passenger and freight train with basic coach and baggage service was assumed to be used.[14] This would lack the comforts of the present sleeper service with meal and beverage amenities, but the distance and time involved would be much less. Analogous to the situation for the air mode earlier, a transition subsidy is illustrated — in this case $40.

# ENDNOTES

1. Ontario Ministry of Transportation, *Provincial Highways Traffic Volumes 1989* (Toronto: Ministry of Transportation, July 1991).

2. Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215, Annual.

3. Statistics Canada, *Air Carrier Operations in Canada*, Catalogue No. 51-002, October–December issues, 1981–1987, and *Canadian Civil Aviation*, Catalogue No. 51-206, 1988–1990 issues.

4. Statistics Canada, *Railway Transport: Part IV, Operating and Traffic Statistics*, Catalogue No. 52-210, 1980 and 1981 issues; unpublished data provided in personal communication by Statistics Canada for 1982–1989; VIA Rail traffic in 1990 from VIA Rail Canada, *Annual Report*.

5. Unpublished data provided in personal communication by Statistics Canada, together with data from Société des Traversiers du Québec, *Annual Reports*, 1980–1988.

6. National Energy Board, *Canadian Energy Supply and Demand 1990–2010*, Catalogue No. NE 23-15/1991 (Ottawa: Supply and Services Canada, June 1991). Table 4-12 shows total car stock and truck stock fuel efficiencies improving between 1989 and 2000 by 1.5 percent per annum and 1.4 percent per annum respectively; 1.4 percent per annum for 9 years 1991–2000 would be an improvement of about 13 percent.

7. CCME, *Management Plan for Nitrogen Oxides and Volatile Organic Compounds, Phase I*, CCME, Nov. 1990. The National Energy Board in *Canadian Energy Supply and Demand, 1990–2010*, Tables 11-2 and 11-3, expects $NO_x$ emissions between 1990 and 2000 to fall by about 50% in cars, 38% among gasoline-fuelled light trucks and 20% among diesel-fuelled light trucks, and VOCs emissions over the same period to fall by 40% to 45% among cars and gasoline-fuelled light trucks, and 30% among diesel-fuelled light trucks.

8. State-of-the-art new aircraft are also expensive; however, this does not have as large a bearing on total cost as does the operating cost side. The financial costs — depreciation and cost of capital — associated with even a relatively young fleet would rarely exceed 10 percent of an airline's total costs.

9. *Air Transport World*, several issues — 1989 to 1991.

10. Growth of 30 percent is assumed for 1991 to 2000.

11. See: "ATC turns a profit" and "New ATC Network Comes in on Target," *Jane's Airport Review*, March 1992, p. 10 and pp. 26–29.

12. The smaller airports are those designated as level 4 and 5 in the airport cost analysis: see "Notes to Chapter 3" in this volume.

13. The Manitoba and Saskatchewan early-1991 provincial fuel taxes of 13.6 cents and 15 cents per litre of fuel used for rail travel within these provinces were used. This substantially exceeds their 9 cent and 10 cent per litre taxes on automobile gasoline. (It is noted that Manitoba raised its tax on gasoline to 10.5 cents per litre in May 1991.)

14. Neglecting the Crown corporation status of the logical operator — CN Rail — some financial support or alternative persuasion might be necessary if the carrier were to be convinced to initiate such a service (where potential profits are small and financial risk substantial).

# Volume

# 3

# DIRECTIONS

## THE FINAL
## REPORT OF
## THE ROYAL
## COMMISSION
## ON NATIONAL
## PASSENGER
## TRANSPORTATION

Volume 3

The opinions expressed in Volumes 3 and 4 are those of the authors of the individual studies and do not necessarily reflect the views of the Royal Commission.

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# PREFACE

Volumes 3 and 4 present a selection of research studies prepared for the Royal Commission by its Research Division staff and by various authors under contract. Volume 3 includes: historical overviews and general surveys related to transportation objectives; studies on subsidies, pricing and competition; and a discussion of institutional issues. Volume 4 includes: applied analyses related to determining the cost of transportation; industry studies of the air, bus and rail modes; and studies on travel demand, taxation and technology.

The historical overviews comprise two studies. The first, by D.R. Owram, entitled "Icons and Albatrosses: Passenger Transportation as Policy and Symbol in Canada," examines the evolution of transportation in Canada, with particular emphasis on rail and roads. The second, by George W. Wilson, entitled "U.S. Intercity Passenger Transportation Policy, 1930–1991: An Interpretive Essay," provides a survey and a critique of U.S. transportation policy over the last 60 years.

Two of the general surveys, namely, that by Robin Boadway, entitled "The Role of Equity Considerations in the Provision and Pricing of Passenger Transportation Services," and that by David W. Slater, entitled "Transportation and Economic Development: A Survey of the Literature," discuss issues related to the inclusion of equity or economic development as objectives for a passenger transportation system.

The studies that discuss subsidies, pricing and competition issues include those by Trevor D. Heaver, entitled "Subsidies in Canadian Passenger Transportation"; David Gillen and Tae Hoon Oum, entitled "Transportation Infrastructure Policy: Pricing, Investment and Cost Recovery"; John Blakney, entitled "Competition Policy and Canadian Passenger Transportation"; and Keith Acheson and Don McFetridge, entitled "Controlling Market Power in Weakly Contestable Canadian Airline Markets." Federal-provincial institutional issues are discussed in two papers by Patrick J. Monahan, entitled "Constitutional Jurisdiction Over Transportation: Recent Developments and Proposals for Change" and "Transportation Obligations and the Canadian Constitution."

The applied analyses in Volume 4 include three studies on the cost of transportation. These are "Transportation Infrastructure Costs in Canada" by Ashish Lall; "Road Costs" by Fred P. Nix, Michel Boucher and Bruce Hutchinson; and "Environmental Damage from Transportation" by VHB Research & Consulting Inc. Of the industry studies, that by Steven A. Morrison, entitled "Deregulation and Competition in the Canadian Airline Industry," and that by Ron Hirshhorn, entitled "The Effects of U.S. Airline Deregulation: A Review of the Literature," relate to the air mode. The bus mode is addressed in "An Analysis of the Canadian Intercity Scheduled Bus Industry" by Richard Lake, L. Ross Jacobs and S. T. Byerley. The rail mode is addressed in the study by Charles Schwier and Richard Lake, entitled "VIA Rail Services: Economic Analysis," while airports are considered in "Airport Investment and Pricing Policies" by A. Cubukgil, S. Borins and M. Hoen.

Volume 4 concludes with studies on three further topics. Travel demand is addressed in two studies. The paper by Eric J. Miller and Kai-Sheng Fan, entitled "Travel Demand Behaviour: Survey of Intercity Mode-Split Models in Canada and Elsewhere," is a general survey of demand modelling. It is complemented by Richard Laferrière's study, entitled "Price Elasticities of Intercity Passenger Travel Demand," which calculates various elasticities of travel demand from several models on comparable bases. The impact of taxes on the cost competitiveness of Canadian intercity passenger transportation carriers, both intermodally and with U.S. carriers, is addressed in "Differential Taxation of Canadian and U.S. Passenger Transportation" by Ken McKenzie, Jack Mintz and Kim Scharf. Finally, a discussion of general technology issues and of prospective technology relevant to Canadian intercity passenger transportation modes over the next 25 years is provided in "Notes on Intercity Passenger Transportation Technology" by Richard Lake.

The contribution of those who participated in the editing and translation of all of the four volumes of this report was acknowledged at the beginning of Volume 1. In addition, the Royal Commission staff was ably assisted in the editing of Volumes 3 and 4 by PMF Editorial Services Inc.

# 1

# ICONS AND ALBATROSSES: PASSENGER TRANSPORTATION AS POLICY AND SYMBOL IN CANADA

D.R. Owram*

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## 1. INTRODUCTION

This essay looks at the evolution of Canadian passenger transportation with a specific question in mind. Why is it that Canadians take such a proprietary, even affectionate, interest in issues of long-distance transportation, especially when railways are involved? Over the approximately one and a half centuries of Canadian history in which we have had a reasonably systematic system of passenger transportation, there have been massive changes in the technology and economics of transportation and accordingly in the way in which the public travels. Various periods have seen the dominance of differing forms of transportation. In the pre-railway era, water travel was by far the most efficient and comfortable. Beginning in mid-century, railways provided a fast, competitive means of travel by land and soon dominated both passenger transportation and land-based freight. In the 20th century, the arrival of cars made travel more feasible on roads, which until then had been a secondary means of travel. As this new technology was perfected and increasing amounts of money were spent on the road system, the car initially provided competition for and then largely displaced the train as a means of passenger travel. Air travel, which arose most recently, further displaced rail travel, especially on those longer distance runs where cars had not yet captured the market.

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Water, railways, roads and air all form important segments of Canadian passenger transportation. Of them all it is the railway that seems to possess the greatest symbolic significance. It rose in the mid-19th century as the new technology of the industrial revolution and soon towered over other forms of transport. Just over a century later it began to lose its central position, especially in the area of passenger transport. The number of passengers peaked in 1944, and thereafter an erratic but irreversible decline began. By the early 1970s railway travel was becoming increasingly unfamiliar to the average Canadian. Yet, despite all the changes, railways had an enduring, even mythic, hold upon Canadians.

People in many nations show a special affection for and interest in their public transportation systems, particularly railways. Canadians seem more fervent than most. From the time that railroads first appeared in North America until the present generation, books, films, songs and poetry have glorified the railway and its place in Canada's destiny. Indeed, when Gordon Lightfoot recorded "The Railway Trilogy" in 1962, he may have made Canada one of the few countries in the world to have a popular musical hit that glorified railway construction. That this was so is testimony to the way in which railways have become a part of popular culture in this country. A Grade 7 textbook of the 1950s reasonably asked the question, "Have you ever crossed Canada by railway?" Even if you had not, the imagery portrayed in the book would likely have been familiar. There was talk of the "kindly porter," "the snug upper berth," and the scenic ride through the "famous spiral tunnels." The passage concluded with the statement that "the road of steel has tied our provinces together."[1]

To explore why such imagery has been so important to the national culture is a complex undertaking. This study attempts to understand our national concerns about passenger transportation by tying together three aspects of its development. First, we will look at the evolution of transportation systems and their importance in Canadian history. Second, we will pay special attention to government policy toward both transportation generally and passenger transportation specifically. Finally, we will discuss how people perceive the various modes of passenger transportation and their roles in Canadian society. Obviously, the three themes are intimately connected.

A great deal has been written on Canadian transportation. This is hardly surprising, for transportation is technology overcoming the tyranny of geography. This being the case, the very geography of Canada has determined the central role of transportation in the Canadian psyche. Geography, it has been argued, has always been central to the Canadian sense of identity.[2] Canada is the second largest nation in the world, and yet it has a small and scattered population. Thus, both the diversity of Canadian geography and the sheer magnitude of it have been inescapable throughout history. A vast nation with a small population means that transportation networks are going to be expensive relative to likely traffic. Yet the very distance involved in the geography of Canada makes efficient transportation all the more necessary.

This unfavourable distance/population ratio has resulted in three of the constants of Canadian transportation history. First, transportation—especially long-distance transportation—has been a more important issue in Canadian politics and economics than in many other countries. It is usually one of the items near the top of the public agenda.

Second, the distance/population ratio has led to a paradox that has confronted politicians, the public and businesses throughout history. In numerous instances a particular transportation project has been considered essential for the community or region involved. Yet, all too often, the small population and large distance meant that there was little or no likelihood of the finished work generating sufficient revenue to be economically worthwhile to any investor. The only way to bridge the gap was for government or governments to make the investment in the name not of profit, but of social welfare (real or perceived). As long ago as 1917 economist D. A. MacGibbon summed it up when he said, "Transportation policy has not been viewed merely from the standpoint of commercial and economic convenience. In the final outcome these national ideas have dictated the course of development."[3]

Third, as will be discussed later, transportation in Canada has come to be seen more than in most countries as central to the very existence of the nation. Although both Canada and the United States used the railway to tie together east and west, the links in Canada are more crucial and more vulnerable. Canada, with a smaller population, has always felt a strong pull toward the larger economy to the south. Given the sharp geographic division between the regions of Canada as well as the artificial nature of much of the Canada-United States border, an effective east-west transportation system has from colonial times been thought crucial to Canada's continued independence. The alternative and geographically natural series of north-south interconnections seems to point to Canadian fragmentation and continental integration.

Geography, then, has created particular difficulties for the development of an efficient Canadian transportation system. This is well known, but equally important is how that difficulty has affected the public attitude. To put it briefly, subsidy has been a necessary part of Canadian transportation from the time mass transportation began. The Canadian public, therefore, is understandably conditioned to look upon transportation not as a series of profit-loss decisions by entrepreneurs but as a public good. That public good argument, moreover, has so far focussed more on trains than on airplanes or cars. This is likely because railways have been central to Canadian nation-building and because it is railway passenger travel that is currently threatened. This mood could, however, also apply to other means of transportation if they too seem both vital and threatened.

A great deal has been written about transportation in Canada, but relatively little on the history of passenger transportation. There has been no general study on passenger transport. Nor have those studying specific areas given this topic a great deal of attention. Instead, the emphasis has been on the construction of infrastructure or the movement of goods. Passengers do appear in studies, but there is little sustained description or analysis. There are exceptions to this rule. The emphasis on freight occasionally shifts during points of competition or crisis in the passenger area. Also, post-war developments of a large-scale air industry, which is more passenger dependent than railways, has tended to focus more attention on passengers. Still, that industry has had relatively few scholarly histories, and the passenger area, though important, remains thinly covered.

Part of this neglect results from the overwhelming attention paid to freight issues. Carriers were interested in the revenue passengers could generate, but the major decisions on construction, route, canalization or whatever were made with an eye to traffic in general, without any specific emphasis on passengers. For this reason it is difficult historically to distinguish between passenger and non-passenger issues. Very often they are part and parcel of the same concern. Even after works were completed the emphasis was often on freight. Only in the second half of the 20th century has passenger traffic become a significant political issue. In contrast, controversies over freight rates go back much farther and, as the history of the Crow rates indicates, have been politicized for a very long time.[4] Only by the 20th century were there consistently distinct corporate policies toward passenger and freight services.

## 2. THE ERA BEFORE RAILWAYS: TO 1850

Three characteristics mark the pre-industrial era in Canadian transportation. First, features of terrain and climate governed transport, for neither the technology nor the capital existed to significantly alter natural conditions. Second, because of this, transportation by water was much speedier and economical than that by land. By far the greatest movement of passengers and freight was along the natural water routes of North America. Third, toward the end of this first phase, the more advanced technologies of Europe began to have an effect on the transportation infrastructure of British North America. Steam power and the modification of the waterways by dredging and canals both improved the transport system and hinted at the more extensive applications of technology that were to become practical in the near future.

The Europeans who came to settle in North America were challenged by the vast and unknown landscape. Dense forests, ranges of hills and low mountains, seasonal freeze-ups and spring thaws all slowed travel. In the first centuries after their arrival Europeans did not have the population, the capital or, for the most part, the technology to significantly alter that landscape. As with the natives with whom they worked and competed, the Europeans had to operate within the North American environment. Fortunately, as any map of Eastern Canada indicates, the early colonists also found the landscape a useful ally: the strings of lakes and rivers provided an unparalleled access to the interior of the continent. The waterways thus became the highways of the colonial era. For more than two centuries the transport of both people and goods largely followed the rivers.

In contrast, travel on land was difficult and slow. Even at their best, roads in pre-Confederation Canada were inferior to waterways as a means of moving people or goods. Also, practically all the roads of this era were seasonal. Good winter and summer travel was possible, but spring-break-up or the transitional fall frosts and thaws quickly rendered roads impassable. These facts shaped road policy. Because land transportation was so difficult in the forested eastern part of North America, settlement clustered around water and looked to water as a means of transportation. There was, for example, no road outside of Quebec City until the 1670s, more than half a century after settlement. Not until the 18th century was there really a system of roads or a structure of government to develop them.[5] Even then they remained feeder systems for the most part, directing people and goods to the more efficient waterways.

Thus European settlements grew along the waterways, and European travel, as with native travel, followed those watercourses wherever possible. New France, whose settlers explored and developed trade far beyond the confines of the St. Lawrence Valley, has been characterized as a river empire.[6] By the 18th century this empire reached west to the Prairies and south to the mouth of the Mississippi. This land was not transformed or conquered, and certainly no large-scale transport system was imposed upon it. Instead, the French operated through alliances with powerful tribes, and their travel in the region was on a small scale and conformed, as always, to the waterways. The Europeans had no technology suitable for such wilderness travel, and thus they adopted the natives' lightweight birchbark canoe. The great advantage of this was that it could be hauled over the numerous portages without great difficulty.[7]

By the 18th century European transportation technology had been introduced, at least in the more settled regions of the St. Lawrence. Flat-bottomed bateaux and local schooners operated between Quebec City and Montreal. Later, after the British conquest of 1763, the Durham boat (a keeled boat) joined the bateaux and schooners. These technologies extended westward to Lake Ontario by the late 18th century as the Loyalists and other immigrants began to settle the region that, in 1791, became Upper Canada.

Within this framework of small craft and a thinly populated continent, passenger transportation was a non-specialized and largely makeshift activity. A barge owner heading upriver or along Lake Ontario would sell space on his unsheltered barge for either freight or people as demand might have it. A crude tent might be erected, used by both owner and passengers, and food would be supplied as a part of the fare. None of this was fixed, however, and there were no formalized agencies or companies engaged specifically in the movement of passengers until around the turn of the 19th century. Government, for its part, had few regulations and no investment as such in the provision of passenger transport. Moreover, even this rudimentary form of travel was limited in two ways. First, it was seasonal. When the river froze (as it did for four months of the year), those who wished to travel had to use sleighs (where they could get through the woods) or snowshoes. Needless to say, long-distance travel in winter was undertaken only under the most urgent circumstances. Second, even under ideal conditions, water transport was slow, especially against the current.

In the first years of the 19th century, passenger transportation began to change. For one thing, the growing population of Lower Canada and the rapid development of the frontier colony of Upper Canada increased demand for organized travel. Entrepreneurs saw that responding to this demand was potentially profitable. Moreover, the harnessing of steam, which was such an essential part of the industrial revolution then occurring in Great Britain, soon affected North American transportation.

In 1807 Robert Fulton demonstrated the practicality of steam power by successfully taking his ship, the *Clermont,* upriver from New York to Albany. Within two years a British North American launched the *Accommodation.* This initial craft was small and not really able to handle the currents of the St. Lawrence. A more powerful craft followed within a couple of years, however, and by the 1820s steamships were common on the St. Lawrence and Lake Ontario. By the 1830s they could also be seen on lakes Erie and Huron. Though steam engines were not yet perfected, these ships provided a degree of freedom from the current and the weather: they could work against the wind. Also, in terms of travel time, they brought points closer together. It was possible by the 1820s to travel from Montreal to Quebec City in about 24 hours. By 1835 a trip from Kingston to Toronto took about the same time, at least under good conditions.

Steamships not only improved the technology of passenger transport but also were of a scale that encouraged some specialization. These ships were not the small craft of just a few decades before, picking up a few passengers as demand warranted. The largest steamships could transport up to 900 people,[8] and travel on this scale had to be scheduled to let customers know of sailings. By the 1830s formalized passenger transport existed between Quebec City and Niagara, with (more or less) regular schedules, fixed fares, sometimes different classes of accommodation and (more or less) comfort.

As both trade and passenger transport became formalized and larger scale, government became increasingly involved, passing various regulations to ensure the safety of steamship passengers. Moreover, contracts to carry the Royal Mail could provide extremely important subsidies to steamship owners seeking to establish a profitable system along the St. Lawrence-Great Lakes system. The government also became involved in another way, one that established a precedent for future activities. Before long, those operating the ships and those travelling or trading along the St. Lawrence began to look to government for help in developing the infrastructure of the transportation system.

The St. Lawrence system was a superb natural highway into the interior of the continent, compared with any available elsewhere along the eastern seaboard. It was far from uninterrupted, however. Montreal and Lake Ontario were separated by a series of rapids. From the time that Jacques Cartier had been prevented from continuing his quest for China by the first of these (hence La Chine or Lachine rapids), travellers had had to make a series of time-consuming portages. Farther inland, at the escarpment separating lakes Ontario and Erie, was the spectacular break of the Niagara Rapids and Falls. Rapids on the alternative route into the interior, the Ottawa River, made travel difficult in that direction.

These rapids were an inconvenience, but for the light canoes and small-scale trade and transport common before the late 18th century they were tolerable. Portaging was simply part of the cost of travelling and trading in the interior. By the 19th century, however, the introduction of larger craft made the obstacles more costly. Moreover, the interior was no longer merely a sparsely populated hinterland. Upper Canada was growing quickly. From a practically unpopulated region in 1780 it grew within two generations to be the largest of the British colonies in North America. Already, by the end of the war of 1812, there were approximately 100,000 people there, and by 1830 that figure would more than double. Demand for cheap and efficient passenger and freight traffic was growing apace.

The result was a clamour for canal construction. The detailed history of this first great transportation enterprise has been told elsewhere, and only the most basic details need to be repeated here.[9] The effort began shortly after the war of 1812, with two separate ventures. One was in Lower Canada, where a group of businessmen decided to construct a barge canal around Lachine Rapids. The other was in Upper Canada, where local businessman William Hamilton Merritt planned the Welland Canal between lakes Ontario and Erie. Both were constructed, though neither their quality nor size was very satisfactory in the early years. Then, in the 1820s the British government provided assistance to the Canadas by constructing the Rideau Canal, linking the Ottawa River to Lake Ontario. By the 1830s it was thus possible, with the right type of vessel, to travel without portaging from Montreal to Lake Erie. The canals were often shallow, with as little as a five-foot (1.5 m) draft, and the route via the Rideau Canal was circuitous.[10] In fact, for practically all freight and for most passengers, transshipment was still the norm. The small craft suitable for the canals were not suitable for the open waters of Lake Ontario.

In 1840 the two Canadas were united, and with improved fiscal capacity as well as a loan guarantee from Great Britain, they made a major effort to canalize the remaining rapids between Montreal and Lake Ontario and to deepen and improve the Welland and Lachine canals. By 1848 there was uninterrupted navigation to a depth of nine feet (2.7 m) from the ocean to Windsor. This, in combination with the refinement of steam-powered vessels that had taken place by the 19th century, revolutionized passenger travel. The passenger who could afford the fare was now able to travel in comfort by water to all of the major centres of Canada West (as Upper Canada had become in 1840). Moreover, the time of travel had been cut, though more important was the relative cheapness of moving heavy freight.

The canal era was a significant one in colonial Canadian history and was one of the key events marking the transition from a pioneer to a settled economy in central Canada. What is especially important for this study, however, is that the construction revealed two important and related paradoxes. First, the cost of canal construction demonstrated the already mentioned paradox brought on by Canadian geography. As a land of vast distances, Canada very much required an efficient transportation system. Yet the very distances involved and the small population made it extremely difficult for businessmen to undertake such works successfully. Though investors, businessmen and government officials might believe that transportation works were crucial, the necessary funds were still difficult to come by.

Local capital was scarce, and international capital was hard to attract for the very sensible reason that many of the works, however necessary, were unlikely to pay the cost of construction.[11]

This was the case with the Welland and Lachine canals. The Welland Canal Company and the Lachine Canal Company, both chartered as private companies, quickly found that they could not raise sufficient funds to do the job. As early as 1819 the Lachine Canal, which had already been subsidized by both the colonial and the imperial government, was taken over by the government of Lower Canada. In Upper Canada the Welland Canal went through a more tortured process of acquisition, but the final result was the same. As early as 1824, wrote the historian of that canal, the "Welland Canal Company was already degenerating into a privately controlled institution for the disbursement of public funds."[12] The disbursements continued, but in a precedent that would echo through other financial crises the government also began to assume more and more control. By the later 1830s it was the largest shareholder, and by 1841 it had assumed direct control of the work.

By the time of the union of the Canadas in 1841, the government owned and operated the canal system. It was built, but not because it was seen as a paying proposition. Indeed, the construction and operation of the canals were always money-losing propositions for the government. Rather, the system was built because the benefits to the population were thought to make the works necessary. This raises the second paradox. The governments were only a little more able to afford the transportation systems than private enterprise. The canal systems imposed a severe fiscal strain on the Province of Canada. Before the union the Welland Canal had nearly bankrupted Upper Canada. The fiscal strain imposed by expensive transportation projects was not confined to the colonial era. As discussed below, it continued well into the 20th century, and echoes of it linger still.

There are many reasons why government allowed itself to become so deeply entangled financially. First, as various studies have shown, the dominant political groupings of the colonies were commercially oriented. They all saw growth as the key to the colonies' future and often, not incidentally, to their own.[13] Second, given this assumption, government was trapped by the same paradox that affected society as a whole. If the work was essential, how could it be abandoned? Third, this problem had an extra dimension at the government level. The canal system had always been promoted as an endeavour that was both progressive and patriotic. This was the way in which Canada could compete with the United States for the traffic of the mid-west. To fail to complete the system could jeopardize not only the national prosperity but also the national existence.[14] It was an argument that was to appear many times in the future.

The burden of canals had nearly bankrupted the governments of colonial British North America. Then, just as the canals were finished and as the government undertook the ongoing cost of operating and improving them, a new and vastly more expensive transportation technology made its appearance.

## 3. LAND TRAVEL DURING THE GREAT RAILWAY ERA: 1849–1920

There was no parallel on land to the significant improvements wrought before 1850 along the waterways of British North America. Yet land travel was a necessity. Settlers needed access to their farms and had to carry their goods to market. For those on the fringes of civilization, access to decent roads was critical, from both an economic and a social viewpoint. Bad roads were ongoing matters of complaint in the pre-Confederation period. As early as 1799, grievances in Upper Canada were focussed on the state of roads. As one official document concluded, "The present wretched state of the means of communication between the several parts of the Province" almost paralyzed commercial and government activities much of the year. The government, it was urged, should take immediate steps "to remedy so serious an evil."[15] The evil was not so readily overcome however. In 1819 a campaign of complaint against government focussed on the inadequacy of land communication.[16] The 1837 rebellions in Upper Canada were in many ways a back-settlement rebellion against the dominating forces on the lake-front, including rebellion against the indifference of the colonial elites toward the road system.

By the 1840s the mood of rebellion had faded, but the farmers' sense of grievance remained. The elaborate canal plans of that decade brought a protest from those who warned that only a few miles inland farmers "lived in a country without practicable roads at a distance from society and civilization." There, because of the lack of effort and direction by government, "they found themselves shut up in the gloomy prison of the eternal forest, excluded from the means of education for their families, from the consolation of public worship, from the blessings of civilized society. But they could not escape."[17] Such imagery rang most true to those inland settlers who, in the 1840s, were pushing north toward Lake Simcoe or westward from London. Even for those in more settled areas, in Nova Scotia and Canada East as well as on the frontier of Canada West, the rhetoric was far from foreign. There were exceptions, but roads in British North America generally remained primitive even a decade or so before Confederation.

Aside from the obvious fact that roads were not very good, however, it is difficult to discern any clear stages in road policy or development before 1850. For one thing, the records of the pre-Confederation road system are sparse and imprecise. This is partly because the road is a much more amorphous concept than, say, is a railway. A railroad either exists or it does not. The same cannot be said for roads. In the years before the car, the trail, suitable only for people on foot and perhaps in existence long before European settlement, became a more defined route passable at least part of the year by horseback. Portions of the route then might be widened and improved to allow carts and wagons and ultimately be surfaced with one of the available technologies of the era. Bridges would replace fords. In all of these considerable changes, however, it is impossible to say for sure whether a new road was created. Yet this is exactly the progression followed by many of the land-transportation routes in the pre-Confederation era. The story of land travel from early New France through to the eve of the railway is one of gradual improvement rather than of any great technological breakthrough such as occurred with the railway or of any vast government effort as was the case with the canal system. Roads evolved as the poor cousins in the transportation system as needs demanded and resources allowed.

Both the limitations of government and the marginal position of roads dictated how road construction and finance were handled in the colonial era. Roads were treated as a local matter. At the extreme this placed the responsibility for the maintenance of a road on the family whose property it fronted. Generally, however, local governments were responsible for roads. Those local governments could and occasionally did use taxation to support the road system, but the general practice was to employ statutory labour. First in New France and then in colonial British North America, legislation required citizens to work for so many days a year on the roads of their locality. Those who did not have the inclination to do so could commute their statutory labour by means of a payment to the local government.

Contemporary and historical sources unanimously agree that the statutory system presented serious problems. First, the level of maintenance and construction on roads depended on the enthusiasm, skill and willingness of the individual settler or, when organized into crews, the competence of the pathmaster and his amateur crew. Second, the effort made depended on the ability of local officials to bring out the population to undertake the work. It was also difficult to ensure that absentee landlords did anything at all along their property frontage. Thus, the quality of an individual road varied considerably from property to property, much less from county to county.[18]

There were always exceptions to the rule that roads were considered local matters. As far back as the 1720s the government of New France had designated certain key routes "chemins royaux" and had used colonial funds to construct and improve them. They had ditches and were 24 feet (7.3m) wide, compared with the 18-foot (5.5m) local, usually undrained, road. Likewise, in the British colonies, the colonial governments got involved in developing what were considered the most important roads. Governor Simcoe of Upper Canada used military funds for work on Yonge Street and the Dundas Road. In Nova Scotia the early 19th century government provided assistance for the main road system, which ran outward from Halifax to settlements like Antigonish, Yarmouth and Shelburne.[19] There were also the "turnpike trusts." These were roads built and maintained by private corporations in return for the tolls received. The main government roads and the toll roads were more likely to be maintained sufficiently to allow wagon as well as horseback traffic, to have bridges over at least the deeper streams, and to be drained in such a way that they could be kept open for a greater period of the year. They were still seasonal and relatively primitive even decades after settlement began in the region.

By the 1830s or 1840s the passenger setting out on a journey between two relatively major centres could hope to travel a road passable for horse and, optimistically, for wagon. The road itself would have been cleared of trees and brush to a width of 16 to 24 feet (4.9 to 7.3m), though shortage of funds or indifferent statutory labour meant the brush continually encroached upon the road and, along with fallen trees and branches, provided recurring obstructions. With very few exceptions, the surface of the road was earth and, of course, highly susceptible to weather conditions. Heavy rain, spring breakup and similar events could quickly render even the best roads in British North America impassable.

Even when the ground was passable, the traveller faced problems. First, there were many low-lying, swampy areas that even a minor rain would turn into a quagmire. In these areas the technology most favoured by road builders was the so-called corduroy road. This consisted of logs (sometimes halved but usually not) laid across the road. Corduroy roads provided support for horse and wagon and prevented vehicles from becoming stuck. The rough surface also slowed traffic and was notoriously uncomfortable. Corduroy roads were necessary and common. They solved the problem of mud but only reinforced the image of land travel as slow and uncomfortable.

Superior technologies were also available. The plank road, which had sawn planks rather than logs, provided a smooth, fast ride by wagon. It was used in parts of the lumber-rich areas of New Brunswick and the Canadas. Even at its peak in the 1840s, it constituted a small percentage of road mileage, however, and required continual maintenance. Unless properly repaired, a plank road would within a few years become impassable because of the rotting and breaking of the surface.

Best of all the technologies was macadamization. The macadamized road consisted of a base of large rocks, progressively smaller rocks above and then gravel on top. In use in Great Britain by 1815, the technology crossed the Atlantic to British North America by the 1830s. It became increasingly common through the next couple of decades, especially with toll-road companies that sought to advertise their superior product. The reality was somewhat different from the rhetoric. True macadamizing was very rare in pre-Confederation British North America. With the exception of a few turnpike trusts near Montreal, the great majority of macadamized roads were really only gravelled. The firm base was never installed because it was too expensive. As a result, the so-called macadamized roads in Canada had neither the durability nor smoothness of the properly macadamized road.[20] Even primitive Canadian macadamization was a luxury, however, reserved for the major roads near urban centres or along certain turnpike trusts. The travellers of the 1850s, for example, might journey out of town on a gravel surface, but within a few miles they were likely to find only bare earth, with corduroy used in low-lying sections.

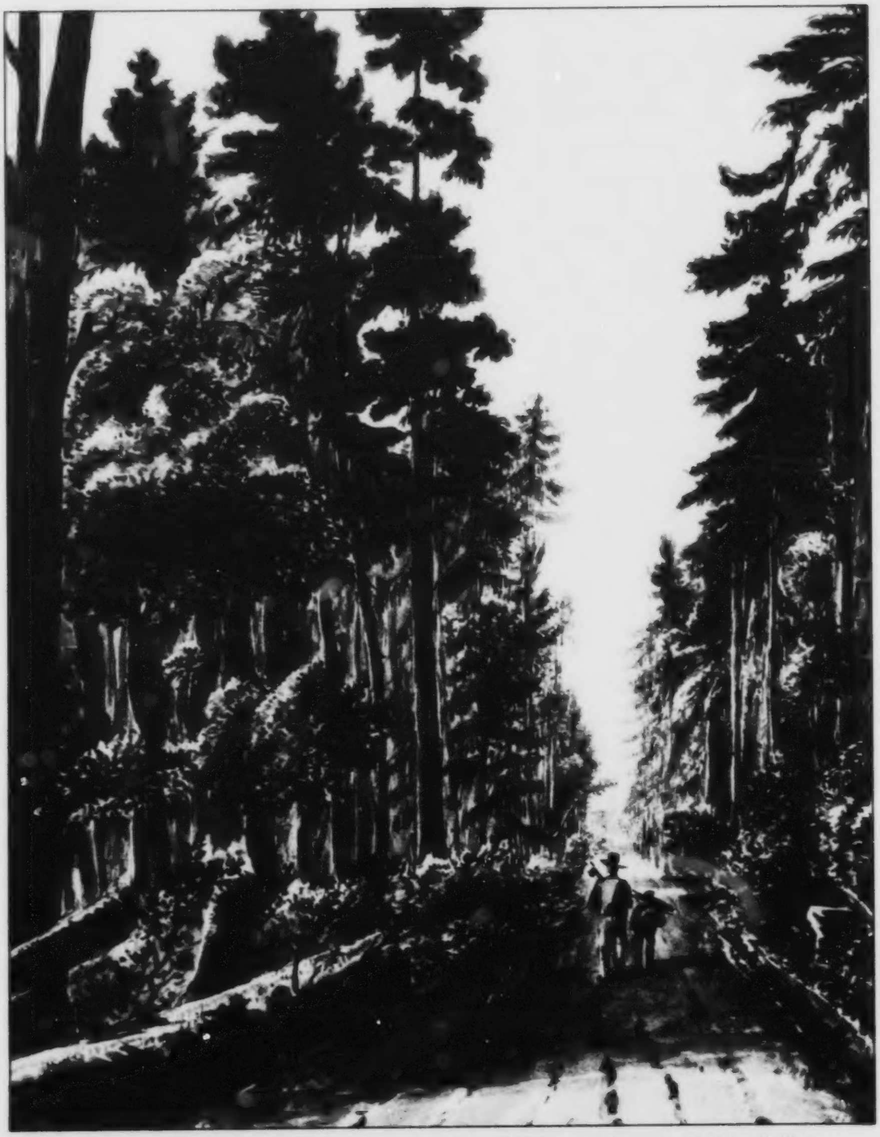
Rivers and streams also provided serious obstacles. Bridges were expensive to build, and colonial authorities avoided construction if at all possible. Travellers usually had to ford streams. Larger bodies of water also prevented easy travel. Often roads went miles off line to a suitable ford. Where bridges had been built, spring floods or severe storms often washed them away. Not until local and provincial public works became more organized around mid-century was substantial improvement made in this area.

The long-distance traveller on even the best roads could not expect an uninterrupted, dry, passable road surface over a long journey. If at all possible, travellers sought alternative ways to reach their destination. The lack of road traffic only discouraged further investment or effort. The roads simply could not compete. Typical was the York (Toronto) to Kingston Road shown in Figure 1. Pushed through in the years after 1815, the road was the major connection for the two largest settlements in the colony. Yet it was impassable for several months each year, required numerous fords, and was always threatened by the encroaching forest. Even at the time of the union it was in part a mere horse trail through the forest, poorly maintained and of marginal importance to all but local travellers.

Despite the obstacles, formalized systems of passenger transportation did develop. By the mid-18th century, stagecoach lines had been established in New France. There was also stagecoach service from Halifax to Windsor in Nova Scotia in the 18th century.[21] By the early 19th century there were regular coach services in the two Canadas and Nova Scotia and New Brunswick. Companies were chartered by the relevant legislature and in return for guarantees of service were often given the contract to move the mail. By the 1830s there was a well-developed stagecoach system running between established settlements. The Montreal–Quebec City run, for example, took place two to three days a week and could be done — under ideal conditions—in two days. But then each day involved 16 hours of bone-jarring travel![22] Less frequent were feeder services running from small inland pioneer settlements to urban centres.

An early 19th century guidebook was pitiless in its denunciation of the stagecoach system, arguing that the roads are "poor" and "the surface rough, the bridges wretched, and the attendance at the inns defective. . . ."[23] For a stage to average five miles per hour (8 km/h) over any distance was to do well. It is hardly surprising that the stagecoach system had little enthusiastic

*Figure 1*
*THE ROAD FROM YORK (1830)*



**Source:** National Archives of Canada, Negative No. 12632 (reproduced in Edwin Guillet, *The Story of Canadian Roads* [Toronto: University of Toronto Press, 1966], p. 38). Artist: James Cockburn (1778–1847).

support. It did have advantages at certain times of year, but it was seasonally restricted by the condition of the roads. Once away from the lake or river, therefore, Canada's transportation system was slow, uncomfortable and dependent upon the weather.

In all these ways, improvement over the last 200 [illegible] had been marginal. It is against this background that the tremendous revolution brought by the railway has to be viewed.

The first locomotive with sufficient power to justify commercial use was George Stephenson's British locomotive, the *Rocket*, which covered 70 miles at an average speed of 15 miles per hour (24 km/h) in 1829. Unremarkable though such speeds might be even a few years later, they were revolutionary at the time. This 70-mile trip was accomplished at the highest rate of sustained speed that man had ever experienced, and almost immediately railway lines were appearing in Great Britain and elsewhere. It was perhaps this sensation of speed and power that so quickly captured the public imagination. Images of power and speed were especially appropriate to the mood of the Victorian era. As many studies have shown, the possibilities raised by the industrial revolution, the effective enfranchisement of the middle class by the Reform Bill of 1832, and other measures convinced societies of the Western world that progress was the natural destiny of humanity. For the British subject, unsurprisingly, the centre of that world's progress was at home.[24] The proof of the progress was, for all its problems, the industrial revolution. Technology, combined with the entrepreneurial instinct, had brought material improvement, moral uplift and the spread of political liberty. And there was no more potent symbol of the power and might of industrialism than the railway. The steam locomotive became a symbol for the accomplishments of the age.

Canadians fully accepted the symbolism of the railway and, of course, feared what would happen if they were left behind. Thus, despite the horrendous costs involved and the small population of the colonies, various enthusiastic newspaper articles appeared from the 1830s onward extolling the wonders of the railway and asserting the need for immediate construction. It was in 1849, however, that the classic Victorian image of the railway was published. In that year well-known Canadian engineer Thomas Keefer published a tract with the pretentious yet appropriate title, *The Philosophy of Railroads*. The pamphlet was widely distributed, going through three editions in English and one more in French within four years.

For Keefer, the steel and steam technology of railways was an almost mystical means to free Canadians from the tyranny of nature. It is no accident that he begins his tract with a reference to the seasons: "Old Winter is once more upon us, and our inland seas are 'dreary and inhospitable wastes' to the merchant and to the traveller. . . ." The energetic activities of the colonizer and trader had been shut down. "The animation of business is suspended, the life blood of commerce is curdled and stagnant in the St. Lawrence." It did not have to be that way, for the Americans, always a powerful point of comparison, remained unaffected by winter. "Far away to the South is heard the daily scream of the steam-whistle — but from Canada there is no escape: blockaded and imprisoned by Ice and Apathy."[25]

This contrast between progress and backwardness, between action and imprisonment, continues throughout Keefer's pamphlet. For though there are facts and figures, pragmatic arguments and suggestions, the tract is above all a morality tale. Indeed, Keefer's work is quintessentially Victorian in its linking of material and moral progress. In the centre is the hypothetical village of "Sleepy Hollow." With the arrival of the railway a spirit is engendered in the village that "is not confined to dress or equipage, but is rapidly extended to agriculture, roads, and instructive societies, and finally exerts its most powerful influence where it is most needed — in the improved character it gives to the exercise of the franchise." For where the railway went, enlightenment followed. "Poverty, indifference, the bigotry or jealousy of religious denominations, local dissensions or political demagogueism may stifle or neutralize the influence of the best intended efforts of an educational system; but that invisible power which has waged successful war with the material elements, will assuredly overcome the prejudices of mental weakness or the designs of mental tyrants" [26] The railway had gone from being an instrument of transport to a general agent for material improvement to, ultimately, the major civilizing force of the modern age.

Keefer's rhetoric may have been more inspired than most, but it both fit the age and reflected the dozens and then hundreds of pamphlets, monographs and newspaper articles that came out in the first phase of railway development in Canada.[27] Moreover, for all the hyperbole and propaganda, it is true that railways had a tremendous impact on the life of the average person. They transformed metropolitan-hinterland relationships, made inland transport cheap and rapid, freed travellers for the first time from the tyranny of weather, and quickly became the largest industrial concern in British North

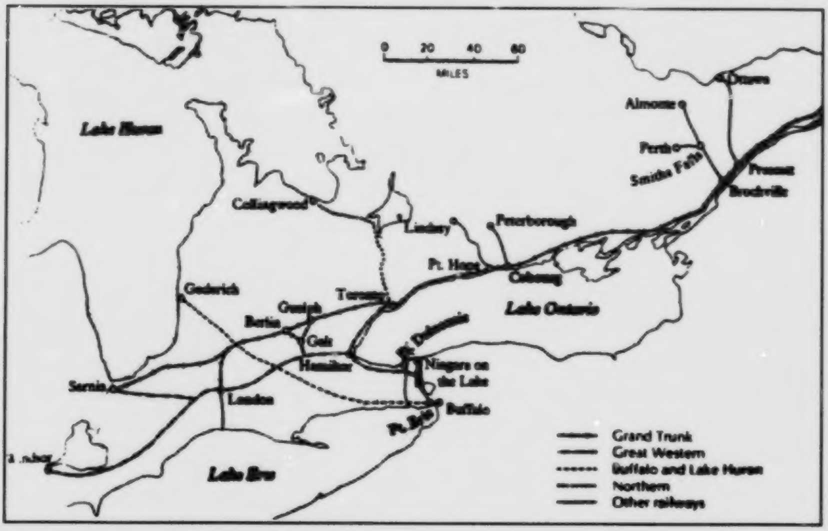
America.[28] All of this reinforced the Victorian predilection to see railways as a metaphor for the progress of their society. Sudden bankruptcies, crooked schemes and the tremendous influence of railway barons on politics did not seriously affect this belief. For whatever the faults of the individual, the railway represented progress, and, it must also be remembered, the Victorian's notion of progress was a seamless web in which material and moral improvement were seen to be linked.

Keefer's pamphlet came at an appropriate time. The year it was published saw the beginning of the first serious railway construction in Canada. In 1849 there was only 66 miles (106 km) of railway in all of British North America. Eight years later there would be 1,800 miles (2,900 km). Millions of dollars (mostly British funds) would be invested (the Grand Trunk line alone cost $67 million), and by the time it was all over many lines found themselves overextended and in debt. Receiverships followed close upon completion of construction.[29]

As with canals, details of the first phase of railway construction and finance are well described in many works and need not be recounted here.[30] Basically, two types of railway were developed in this first period. One type was a feeder line, either to American lines or, more commonly, to water. Nova Scotia linked inland communities and the three coastlines by rail. In Canada West, railways like the Canadian Northern tapped the growing hinterland from Toronto to Aurora, Newmarket and ultimately Collingwood. The other type of railway was more ambitious. It was a trunk line designed not to feed the lakes but to provide a land-transportation axis from east to west. Both the Great Western and, most important of all, the Grand Trunk were this type. The latter, running from Sarnia to Montreal and then Quebec City, became the industrial giant of the age and a major force in the commerce and politics of Canada until World War I. By 1860 British North America had some 2,000 miles (3,000 km) of railways, most, as Figure 2 indicates, located in Canada West.

The relevant governments played a vital role in the evolution of these railways — in the negative decisions it made as well as the positive. Moreover, the decisions made during this first construction boom created precedents for government policy that lasted much longer than many of the railways then built. First, the Government of Canada determined that railways should *not* be directly built and operated by it. Likewise, the Government did not assume responsibility for such support systems as railway stations like it did for harbours or, much later, airports. In all of this, the lessons of the canal era were crucial. Canals had led to tremendous financial strain, and their costs were nothing compared with the huge outlays needed for railways. At the same time, the Government was under the same pressure to develop railways as it had been earlier to develop canals. The railway, as Keefer's pamphlet argued, was crucial to the whole destiny of this young colony. Thus the Government sought to steer between the two extremes.

*Figure 2*
*RAIL LINES IN CANADA WEST, 1860*


0 20 40 60
MILES
Lake Huron
Collingwood
Lindsay
Peterborough
Ottawa
Almonte
Perth
Smiths Falls
Prescott
Brockville
Pt. Hope
Cobourg
Lake Ontario
Goderich
Toronto
Guelph
Berlin
Galt
Hamilton
Dalhousie
Niagara on the Lake
Sarnia
London
Buffalo
Pt. Erie
Lake Erie
Grand Trunk
Great Western
Buffalo and Lake Huron
Northern
Other railways

**Source:** R. Cole Harris and John Warkentin, *Canada before Confederation: A Study in Historical Geography* (Toronto: Oxford University Press, 1974), p. 155.

Its strategy was to use indirect and occasionally direct subsidies. The single most important means was provided by the *Railway Loan Guarantee Act* of 1849. As the title implies, this Act allowed the railways to obtain guarantees on bond issues from the Government under certain conditions.[31] Such a guarantee removed much of the risk to the investor and made it feasible for entrepreneurs to tap the large capital markets of Great Britain. The *Municipal Loan Act* of 1852 allowed cities and towns to draw upon provincial credit guarantees if they wished to support railway projects in their area.[32]

In theory these acts provided a means of support for railway construction, at least under ideal conditions, without actually costing the taxpayers a penny. Not surprisingly, it wasn't that tidy. Railways borrowed heavily, and municipalities proved especially prone to railway fever. They had to, for the place of their community in the future hierarchy of trade and power depended on the railway. Many railways came crashing down, required reorganization or defaulted on their bonds. The Government had to step in on several occasions to rescue the railway or the overloaded municipality. By 1857 the first phase of railway construction was over, and for the next decade governments, companies and British bondholders sought to recover from the spree. All of this was reasonably predictable. Hundreds of millions of dollars had been spent in a region with a very small population and capital market. Still, the railways were in place, and this revolutionized Canadian transportation.

The railway affected the structure of industry in the colonies and the metropolitan-hinterland relationships, while the actual construction provided a major impetus to capital formation in the colonies. Those cities, like Toronto, that were the terminal points of major railways were the greatest benefactors. Extended hinterlands, new industries and the presence of considerable financial empires distinguished these cities from smaller pretenders and did much to establish the pattern of urban relationships that are still familiar today. For people as well as commerce the railways revolutionized life. For the first time it was possible to move as comfortably and rapidly on land as it had been on water. The farmer or merchant living inland in Galt or Barrie or elsewhere now had easy access to local towns or the larger cities. The hold of the seasons upon travel was considerably weakened and, with the improvement of snowploughs over the next decade or so, effectively broken. Year-round travel was now possible for the first time. In that sense Thomas Keefer's opening sentences about the hold of winter were entirely appropriate.

## THE PROJECTS OF CONFEDERATION: THE RISE OF THE RAILWAY AS NATIONAL SYMBOL

Both railways and canals had been seen by governments in the colonial era as developmental necessities worthy of support. The projects had often had pro-British (that is, anti-American) overtones as well. It was at the time of Confederation, however, that transportation issues became linked closely to nationalism. Confederation was accomplished in a mid-Victorian era, when faith in the industrial revolution and technological progress was high. One of the major impetuses behind Confederation was also physical expansion by the Province of Canada, which wished to "extend eastward to a port not in American hands and westward to new areas of trade and settlement."[33] The new Dominion was thus soon faced by the problem of continent-wide distances that only the railway seemed able to resolve.

The Province of Canada was not alone in seeking railway arrangements as a part of Confederation. In the Maritimes, early railway projects had brought the colonies near bankruptcy. The failure in the early 1860s of a projected railway link between Halifax and Quebec City had also left a feeling of bitterness, for the "Upper Canadians" were widely blamed for its collapse.[34] Those who supported expansion into the vast Prairie region realized that only the railway would make meaningful connection to the rest of Canada possible. Still farther west, British Columbia's entry into Confederation in 1871 made sense only if there was to be a transcontinental railway. Great Britain, having experienced the difficulties of moving troops overland during an Anglo-American war scare in 1861, was also supportive, especially of the Intercolonial Railway project.[35] Railways thus became linked with the very process of nation building. The Intercolonial Railway was actually written into the Constitution, the *British North America Act, 1867* (s. 145), making Canada perhaps the only nation in the world with a railway as part of its fundamental law. Once the precedent was established it was tempting to continue to invoke it. British Columbia's entry into Confederation was rewarded with a promise of a rail link to the Pacific; Prince Edward Island's, with a federal takeover of the bankrupt Prince Edward Island Railway.[36]

The close connection between the political act of Confederation and the economic policy of railway development had important consequences. First, the imperative of national development led the Government to make exceptions to its policy of avoiding direct construction and ownership of the railway. The Intercolonial had to be built, but as one of Canada's senior engineers warned, "it offers no material for a flattering prospectus; we could not invite it to the attention of European capitalists as presenting an eligible investment for their surplus funds. But for the establishing of those intimate social and commercial relations indispensable to political unity . . . the railway is a necessity."[37] There was thus no choice for the Government but to build it itself.

Dependence on the Government brought problems. For example, the choice of route — the so-called northern route — saw purely commercial considerations downplayed in favour of military and political ones. Also, there were fears of patronage (for good reason, given the times), and a cumbersome, three-layered authority was set up: the chief engineer of the Department of Public Works, the Government and appointed commissioners. Finally, once the taxpayer's money was involved, decisions on quality of construction became political topics and led to a great deal of wrangling back and forth.[38] Not all the problems were resolved satisfactorily, but by 1876 the first through train ran from Halifax to Quebec City.

The second implication of this national project was that having been built it could not easily be abandoned when it proved costly to operate. The Government had hoped to get rid of it by sale or lease to a private operator such as the Grand Trunk. The Intercolonial was no more attractive to operate than to build, however, and it became a Government railway line, operating at a loss from the day it was opened. Before long the Government also acquired another railway, along with a province. Prince Edward Island had resisted Confederation but had not been able to resist railway fever. By the early 1870s the Prince Edward Island Railway had brought the small colony to the edge of bankruptcy, and Canada moved quickly to offer to bail them out: it would assume the inefficient and badly built railway in return for that colony's entry into the Dominion. By 1873 the deal was completed, and the Department of Public Works found itself in charge of yet another railway. It too operated at a loss.

The Government's involvements in these Maritimes railways were patently political bargains. Many people in the Maritimes since then, therefore, have seen adequate service for passengers and reasonable freight rates as not just another regulatory decision but a part of the basic constitutional package of Confederation. In the 1920s the powerful Maritimes Rights Movement sprang up to protest apparent federal indifference to a region undergoing economic decline. Much of the rhetoric and anger of this movement, as we will see, were focussed on Government management of the Intercolonial.[39] Likewise, during the more recent controversies over VIA Rail service, Maritimers pointedly argued that the Intercolonial was a part of the Confederation pact.[40]

The scope and cost of the Maritime railways were nothing compared with the greatest railway project to come out of Confederation: the transcontinental Canadian Pacific Railway (CPR). The story of the construction of the CPR has been told on numerous occasions. Suffice it to say here that after some failed organizational attempts in the early 1870s, there was desultory and half-hearted construction, accompanied by energetic surveying in western Canada in the late 1870s. Then in 1881 the Government enticed the famous "Syndicate," headed by James Hill, George Stephen and Donald Smith, to undertake the work in return for suitable incentives. Remarkably, that work was completed by November 1885. Unlike the eastern railways discussed above, the Canadian Pacific soon became profitable and astounded its creditors by quickly repaying outstanding loans. It rapidly became the most important corporation in Canada and one of the major railways of the world.

Government policy toward the CPR was based on traditional forms; that is, the Government avoided ownership and gave subsidies instead. Some direct Government construction was undertaken in the 1870s by the Liberal administration of Alexander Mackenzie, but the major portion of the line was constructed on principles derived from earlier railway ventures in Canada and from the United States. Specifically, the Government offered the investors three types of subsidy. The first, borrowed from the Americans, was a land grant — the famous 25 million acres. The second was cash, initially $25 million. The third was a series of privileges accorded the CPR: the remission of duty for construction materials, the promise of monopoly between the main line and the border for 20 years, and other lesser provisions. As construction went on and the company ran into financial difficulty, additional support was given.

There has been much debate over the years, and especially recently, about whether all of these subsidies were needed.[41] It is unlikely the question can ever be answered conclusively, but from the point of view of this study that is less relevant than the simple fact of subsidy. For the subsidies created an ambivalence in the relationship of the CPR with the Government that persisted thereafter. On the one hand, the CPR is not a purely private work. The CPR is often seen by the Government and the public as having a particular public service role, resulting from the support it was given at the beginning. On the other hand, as the CPR has pointed out at various times, it is a private company. Once it completed construction, it repaid Government loans and operated on a self-sufficient basis thereafter. As a CPR publication of the 1940s put it, these government supports should be seen as "payments for service rendered" rather than as subsidies at all.[42] From this perspective the CPR has a primary duty to its shareholders to uphold its profitability and therefore to operate freight or passenger services as commercial needs dictate and not as an agent of social or political policy.

The most important aspect of the CPR, however, is the standing it has assumed in the Canadian psyche. No other railway, and perhaps no other commercial project in Canadian history, has assumed such an important place in the public consciousness. The CPR has become a legend and a symbol in both scholarly and popular history, and the nature of that legend says much about the values Canadians attach to their railway system.

The CPR was controversial from the very beginning. The early attempts to create a viable private company collapsed amidst the Pacific scandal of 1873. Along the way it brought down the government of John A. Macdonald. Then, when the Syndicate was formed in 1881, there was a great deal of controversy over both the principle of vesting such massive power in one group and some aspects of the subsidies, especially the notorious monopoly clause.[43] From potential investors came the warning that the railway could look forward to a "long and dreary season of unprofitableness."[44] The controversy only intensified when the railway was completed. Almost immediately Manitoba attempted to subvert the monopoly clause of the charter, and farmers' groups were protesting the high-handed attitudes of the railway before the 1880s were out. Resentment against the power and policy of the CPR flared regularly across the West. Freight rates, grain-elevator policy and the need for branch lines made the CPR a much-loved object of hate through Western Canada. Indeed, many of the agrarian organizations and reforms that came about over the years owed much to a common hatred of the CPR.

Even more powerful than this distrust of the corporation was a national enthusiasm for the railway itself. Titles like *The Romance of the Canadian Pacific Railway, Steel of Empire, Canada's Great Highway* and, best known of them all, *The National Dream* reflect something of the romance and glory attached to the railway over the years. Even in the West the predominant writing on the railway has tended to distinguish between the corporate rulers, eastern and callous, and the railway itself — a vital lifeline on which westerners worked, travelled and depended for trade.

Part of the image of the railway has much to do with the sheer ambition of the project. As the advertising copy for the 1949 movie "Canadian Pacific" dramatized it, this was "The story of a railway that couldn't be built . . . but was."[45] This romantic image of the CPR began with contemporary accounts of the adventure and hardships involved in its construction. The treks through uncharted wilderness, the bogs of northern Ontario, the hardship and even the deaths all became a part of the glamour of the project itself. Equally, early travellers over the line — often before the line itself was complete — related details of the hard work, the danger and the adventure that surrounded the project.[46] The CPR, still desperate for money and respectability, did everything it could to encourage such writing. The travel of the prestigious British Association for the Advancement of Science over the line in 1885, for example, led to good publicity.[47] So too did the transportation of troops west to suppress the Riel rebellion in the spring of that year.

As time went on, the romance of construction was reinforced by a sense of nostalgia and the important fact that the dubious venture of the railway had in fact succeeded. As the Canadian Pacific survived and then prospered, repaid loans and made profits, the earlier uncertainty disappeared. The very decision to act became as romantic as the action itself. "It was in itself an act of splendid audacity for a people of less than four millions in number to start on the task of throwing a railway across an immense and almost uninhabited continent to the shores of the Western sea," wrote one enthusiast in the 1920s.[48] The actual construction, for its part, became a part of the great Canadian epic of taming the wilderness. When engineer Sandford Fleming witnessed the laying of the last spike he linked it to the earlier generations of fur traders, "the Mackenzies, Frasers, Finlaysons, Thompsons, M'Leods, MacGillivrays, Stuarts, MacTavishes, and M'Loughlins, who in a past generation had penetrated the surrounding mountains."[49] Time has not eroded the tradition, and many others since have emphasized the last spike as part of the exploits of men who conquered the wilderness. The official government plaque commemorating the last spike concludes, "A nebulous dream was a reality: an iron ribbon crossed Canada from sea to sea. . . . Here on November 7, 1885, a plain spike welded East to West."[50]

There is yet another strand to the legend of the CPR. Victorian popular beliefs held that the individual could make a real difference through the application of hard work and will. The myth of the CPR was a celebration of both the Protestant work ethic and the industrial revolution.[51] People like

Stephen, Hill and Van Horne were naturals for such a role. Daring to venture where others feared to go, they made themselves the most powerful businessmen in the land. They were the "captains of industry" who had carried through such an audacious act, who had triumphed over the doubters and the sceptics. They were the "men of vision" to undertake the task, to do it well and to complete it.[52] In their lives and characters they became archetypes, symbols of the values and morals of an age. William Van Horne was not just an exemplary railway builder but a paragon of hard work and morality. During the Chicago fire, it was recorded, he had risked life and limb to remove material from his company's offices. Then, black with soot, he returned home only to continue his heroic endeavours: "Reassuring himself of the well-being of his wife and her infant, he set to work very quietly and industriously to strip his home of everything, and more than everything, that could be spared." Bedding and clothing were then sent to "the shivering refugees from the South Side who were camped in the park."[53] In the more jaded world of the late 20th century the men of the Syndicate have stood up much better than most Victorian heroes. Their courage and competence seem to distinguish them from other old idols who were shoved aside as new sensibilities emerged.[54] Even in their less desirable attitudes the men of the Syndicate were romantic figures, "larger-than-life characters, who ruled with the kind of iron-fisted autocracy that may never again be possible."[55]

The adventure, the romance, the embodiment of hard work and even vision have all been assigned to the Canadian Pacific or its builders over the years. All of these characteristics are, however, merely embellishments upon the main symbolism of the railway — nationalism. As a CPR publication immodestly concluded in 1946, "All down the years Canada and the Canadian Pacific have marched ahead together. Indeed, to the world at large, the two have become synonymous."[56] Self-serving though such a company statement might be, it is also a reasonable claim. For in both the scholarly and the popular portrayal of the CPR, nationalism has loomed large. This nationalist image, moreover, has survived to the present and may explain much of the uneasiness about the decline of the most visible of all railway activities, passenger service.

The national connection is, of course, based upon historical fact. At the time, both the Government and the CPR recognized that annexation and settlement of the North West was impossible without a railway. Equally important, however, was the evolution of a particular geopolitical analysis of the nature of Canada. This viewpoint reinforced the premises behind the Canadian Pacific and became central to later popular as well as scholarly interpretations. This geographical aspect was summed up in its starkest form by the late 19th century intellectual Goldwin Smith. Canada, he said, was really "four separate projections of the cultivable and habitable part of the Continent into arctic waste."[57] For Smith such geographical realities meant that Canada's inevitable destiny was annexation to the United States. For most other observers the result wasn't that inevitable, but the difficulties posed by the geography of North America were central to the analysis of Canada as a national entity.

Few assessments of the Canadian economy and nation ignored Canada's distinct geographical regionalism. It was, however, the "staples school" of Canadian economists that turned physical reality into an elaborate and influential theory. Aspects of the theory were present in the works of pioneer political economist O. D. Skelton.[58] In the 1920s, W. A. Mackintosh of Queen's University and Harold Innis of the University of Toronto made the theme explicit. The massive research work of the Rowell-Sirois Commission (1937–41) drew upon the work of a generation fully imbued with these ideas and incorporated it into its own assessment of the Canadian nation.[59]

The staples thesis in its basic form posited that colonies grew to economic maturity through the exploitation of a series of staple products — furs, timber, wheat, minerals. Such staples, under certain conditions, provided the means for population growth, development of entrepreneurial skill, and capital formation. These things, in turn, permitted the development of a more complex economy. The formation and evolution of a staples economy were also seen to have a major role in national development. Commercial links developed in this manner determined imperial and then national boundaries. This was what explained Canada's separate existence in North America. The staples exploited through the centuries had been linked into an East-West trade system with Europe (and especially London) as the metropolis. This East-West system overrode the disuniting forces posed by geography and tied the regions together. In a famous phrase, Mackintosh said that Canada existed "in defiance of geography."[60] Innis, looking to the rivers as a precedent, disagreed, stating that it existed because of geography.[61] All economists of the staples school, however, felt that railways were the technological instrument that allowed the East-West trade flow to continue into the modern age.[62]

The distinctly unromantic prose of Innis and Mackintosh contained within it a dramatic historical theme. For in their interpretation the credit of creating and maintaining Canada went to those who in some way grasped the essential reality dictated by geography and shaped by national pride. Exploitation of staples wasn't just a matter of luck but of policy. Those who failed to understand or who deliberately stood in the way of the opportunities were seen as negative, narrow individuals, opposing destiny.[63] This was clearly sensed by those who, drawing upon the staples thesis, developed what became known as the "Laurentian Theme" of history.[64] Individuals with more flair for drama (and more readers) picked up the themes of Innis and Mackintosh and merged them with the long-standing romance associated with the CPR. Perhaps the best known of these individuals was Donald Creighton, the foremost historian of the years surrounding World War II. Creighton first picked up the vision of the east-west transcontinental vision from Innis, whom he much admired, and translated it into his own words in his 1937 work, *The Commercial Empire of the St. Lawrence.*[65] This work dealt with the years of furs and canals and thus predated the CPR. This was only the first part of the story as far as Creighton was concerned, however, and he brought the vision to fullest fruition in his masterful two-volume biography of John A. Macdonald. Macdonald and those who comprehended the vision of a transcontinental Canada became heroes. Confederation and the Canadian Pacific were made inseparable, and people like Stephen and Van Horne were idolized.[66] Creighton's work became classic, one of the best selling works of academic history ever written in Canada. As such it did much to reinforce and expand the association of the CPR with the national vision, especially as the work was published during a period of post-war nationalism and confidence.

Yet Creighton's readership pales when compared with that achieved by Pierre Berton's rendition of the CPR legend. Published in two volumes in 1970 and 1971, Berton's history of *The Great Railway* was a phenomenal success. In a country where a sale of 5,000 books can create a best-seller, his railway books sold more than 100,000 copies and are still in print. Furthermore, the works were later developed into a mini-series by the Canadian Broadcasting Corporation. Taking a romantic nationalist interpretation of Canadian history, Berton used a popular variant of the Laurentian school. Even the title of the first volume, *The National Dream,* summarized the symbolism of the railway:

> Macdonald's vision of Canada did not stop at the Great Lakes; his dream was of a transcontinental British nation in North America — a workable alternative to the United States. To achieve this dream, the railway was a necessity, or so the Prime Minister insisted: it would stitch the scattered provinces and empty territories of the West together, as the government-owned Intercolonial was intended to do in the east; . . . it would forestall American expansion; it would be the spine of empire, an Imperial highway linking the British Isles with the Orient and avoiding the appalling voyage around the Horn.[67]

Berton's books were so successful not just because of the popular name behind them or the readable prose. He has written many other books, before and since, and none have matched these in impact. What made them so remarkable was that he adopted a set of beliefs about Canadian development and about the importance of the railway to that development that was already firmly established in the Canadian mind. The fact that he wrote at a time when the national sentiment was still high in the wake of Expo 67 and at a time when railway passenger services seemed threatened simply accentuated the appeal.

Berton and Creighton have been singled out only because they are among the best known and best selling historians of the era. Numerous others could have been cited, and at some point a graduate thesis will dissect the components of Laurentian nationalism. What is important, however, is that a part of the standard wisdom of Canadian nationalism is that there is a close connection between the success of the railway and the triumph of the young Dominion. It is a lesson taught by the scholarly interpretations implicit in the national policy and staples thesis; it is taught in the textbooks of school children; and it is found in the many popular readings on railways. There is even the already-mentioned hit song by Gordon Lightfoot and an epic poem, "Towards the Last Spike," by E.J. Pratt. " 'No Road, No Union,' and the converse true / East-West against the north-south run of trade."[68]

The CPR has from the beginning recognized the marketing and political value of such an image and uses it whenever possible. It has even hired popular historians to recount the daring, the vision and of course the nationalism of the railway. For example, John Murray Gibbon's commissioned work, *Steel of Empire*, published in 1935, links the railway not only to Canadian nationalism but also to the age-old European dream of a connection to

China. The first chapters deal not with the CPR at all but with the long-standing search for a route to the East, the exploits of the fur traders, and other incidents in Canadian expansion across the continent. The message is clear. The CPR was not just the whim of some Confederation-era politicians but the culmination of a centuries-old dream.[69]

The nationalist imperatives that surrounded the construction of the Intercolonial and the CPR added a new dimension to the railway in the Canadian mind. From social or economic necessity it had now become a national necessity, even an icon. The additional elements of success, daring and romance only added to the appeal. For some Canadians the transcontinental links were a part of the Confederation package. Maritimers have long argued, for example, that the Intercolonial was "part and parcel of the contract of Confederation."[70] Even for Canadians who did not interpret provision of rail service as a quasi-constitutional arrangement, the railways and especially the Canadian Pacific were intimately connected with the founding of the nation. That connection was and is reinforced by the tremendous success of the project. Here in a dry, unemotional Confederation process was a heroic achievement on a world scale. The nationalist association, as we will see, spills over to all railways in Canada to a degree. The public's sense of attachment to railway travel, or to the possibility of railway travel, is very likely linked to their identification of successful, operating railways as a part of the national framework.

The railway now totally dominated land travel over any distance. In contrast, the development of roads languished. Indeed, as many later saw it, the emphasis on railways precluded any serious attention to roads. As a 1930s Ontario royal commission put it, "For many years they [roads] had been neglected in favour of the railways. . . ."[71] This echoed a theme that had been around for some time. In the late 19th century a group of citizens came together to complain about the state of roads: "Had railroading and navigation by steam been deferred for another half century, we would have been advanced farther in the science of road-making."[72]

Certainly the railway made the road even more marginal than it had been. For the railway was able to go inland, to penetrate beyond the headwaters and to go wherever sufficient commerce and passenger traffic existed. Railways became both the feeder systems to water and, as in the case of the Grand Trunk, competitors with waterways. Passengers travelling between cities now had a fast, year-round and comfortable means of travel. As the rail system developed throughout Eastern Canada from the 1850s to 1880s and Western Canada from the 1870s through early 1900s people had fewer reasons to travel any distance by road. Even in the neighbourhood of cities the road came under challenge. Commuter trains and their short-haul analogues like streetcars meant that rail travel became the basis for early commuting and suburbanization.

It is difficult to make too many generalizations during this era of neglect. Still, a few general points are apparent. First, the Dominion government had a very limited interest in the Canadian road system. Whereas other public works, namely the canals, had been declared to be for the national benefit under section 92 of the *British North America Act, 1867* and though railways became objects of national policy and large subsidies, roads were ignored. Second, among the provinces and territories, local administration was the rule. Roads were left to counties or their equivalents to maintain and improve. Statutory labour, local tax levies and rare provincial subsidies were the basis of a rudimentary, underfunded system, one that saw maintenance on all but the most major roads conducted in just a few short weeks every year.[73]

There was one exception to this general rule of indifference, though the exception is a spotty one. The federal government and some of the provinces were active on the frontiers of settlement. The development of colonization roads was a practice that predated Confederation and was continued for sometime thereafter in both Ontario and Quebec. Where crises of access developed, as during the British Columbia gold rush of the 1850s and 1860s or the Yukon gold rush of the late nineties, crash programs were often undertaken. When the effort was made the results could be impressive. Immediate imperatives in the 1860s saw the completion of the Dawson route, a mixed water-land route from the Lakehead to Manitoba, and the 385-mile (620 km) Yale Road, built to handle gold rush traffic in British Columbia.[74] Even in these exceptional instances, however, roads were viewed as poor substitutes for railways. Indeed, the assumption was that the road was a temporary measure, preparing the way for future railway development. The Dawson route was never thought to be a long-term solution and was abandoned after the CPR replaced it. It would be many decades before the Lakehead and Winnipeg were once again connected by road. Likewise, parts of the Yale Road were abandoned when the railway reached British Columbia. In the Yukon the boom times of the turn of the century brought immediate plans for the replacement of the rough trails inland with a railway.[75]

Finally, in contrast to the railways, roads played no part in the national imagination of 19th century Canada. They were, if a topic at all, one of complaint on a local level rather than of dreams at the national. This is reflected in the historiography. O. D. Skelton's book, *The General Economic History of Canada 1867–1912*, ignores roads.[76] As part of the massive 23-volume history of Canada published in 1914 by Adam Shortt and Arthur Doughty a special 112-page article on land transportation was commissioned. Roads got just over six pages of coverage before the article shifted to the really important story — railways.[77] Even as late as 1938 the standard study of transportation in Canada by G. P. de T. Glazebrook has nothing at all on roads between 1867 and 1900.[78] Every chapter in this book from Confederation to World War I has "Railway" in the title. Not until the 1960s, by which time the importance of roads had changed considerably, did anyone write anything significant about their history. As it is in history, so it was in the contemporary material: the monographs, government studies, public debates and other materials were mainly on railways or canals, not roads. Roads were referred to, of course, but only as incidents in travel memoirs — usually horrible, occasionally pleasant — and not as a significant element in the national vision. Roads remained at the margin of Canadian transportation policy between the arrival of the railway and the turn of the century.

## PASSENGER TRAFFIC AT THE TURN OF THE CENTURY

It is extremely difficult, except in the most rudimentary way, to distinguish between policy aimed at railway passengers and that aimed at railway freight before the late 19th century. In the minds of governments and companies, development was designed to encourage the transport of both. Yet it is likely that the romance attached to railways over the years applies more to passenger travel than to freight. An individual's sense of connection with the railway has much to do with memories of trips on the railway to visit relatives or friends or to take holidays. It may also have much to do with family history, with parents or grandparents whose life in Canada began with a railway trip. For many more the railway was until recently the primary tie to the outside world, connecting isolated rural communities to the larger centres. It is therefore crucial to explore the evolution of passenger policy and the passenger experience more closely. With the approach of the 20th century, railway and government policies changed, making it easier to trace this evolution.

Government involvement in railways was initially experimental and fluid, as might be expected: it was coming to grips with a new technology. Much of the pre-Confederation legislation was designed to control the financial and construction excesses of this powerful new form of corporation. Railway acts were concerned with destroyed animals, seized property, ruined fences. Legislation created a Board of Railway Commissioners to try to ensure railway compliance with the rules.[79] The railways, for their part, more or less did what they felt was necessary and then sought to present their case to government or the courts. In the actual operation of the railway, however, initial government activity was limited to two general areas. First, there were rules on passenger safety, an understandable intervention given the horrendous accidents that began to occur as soon as railways began operating in the 1850s. Second, there were rules to prevent discrimination, drawn from British precedent of the railways as "common carriers." Under this principle all people are offered similar services at similar prices.

With Confederation, colonial precedents were carried forward. In particular, the concept of the common carrier was now well established, and the Railway Committee of the Privy Council was established under the 1868 *Railway Act* to oversee railway activities. This body of appointed politicians had the responsibility for everything from rules of signage to right-of-way privileges. Also within its ambit were rules for the safety and comfort of passengers. The committee was far from ideal as a means of railway regulation. It had neither the staff nor the expertise to undertake detailed investigations. Nor did it always comprehend the implications of the decisions it made. This was also an age of laissez-faire, and the tradition of regulating the common carrier contended with a desire to leave private business alone. Still, by the time the committee went out of business in 1903, a considerable body of statutes and regulations on passenger transport had evolved in Canada. The most important elements of these were incorporated into the new *Canadian Railway Act* (3 Edw. 7, c. 58). The Act also gave the newly appointed Board of Railway Commissioners power over such passenger issues as standards of the railway station, the conductor's right to expel passengers and various safety measures. Further, in a precedent that could, if extended, apply to line continuation, the Act gave the Commissioners the right to set tolls and to force trains to alter schedules to assist passengers in making connections between different corporations (s. 284). Thus, as early as 1903, the doctrine of the common carrier contained within it the principle that railway operations, and presumably profitability, could be intruded upon in the interest of not only public safety but also public convenience.

Parallel to this was a growing effort by the railways to attract passenger traffic. From the beginning the CPR understood both the dollar value and, perhaps more importantly, the positive publicity that went with satisfied tourists. The West was still the frontier, and the promise of good hunting and dramatic sightseeing and the opportunity to meet real Indians and cowboys attracted tourists from more eastern lands. In the years immediately after the completion of the railway it became common practice for affluent British tourists to make the trek across Canada and write about their experiences. The authors naturally sought, with greater or lesser skills, to convey a sense of romance and adventure, which only added to the aura of the Canadian railway adventure.[80] In the East the Canadian Pacific and the Grand Trunk issued guidebooks that talked of the glories of Niagara Falls or of fishing in New Brunswick.[81] More will be said about the tourist trade below, for, although it was a growing part of the railway business, it was not until later that it became really important.

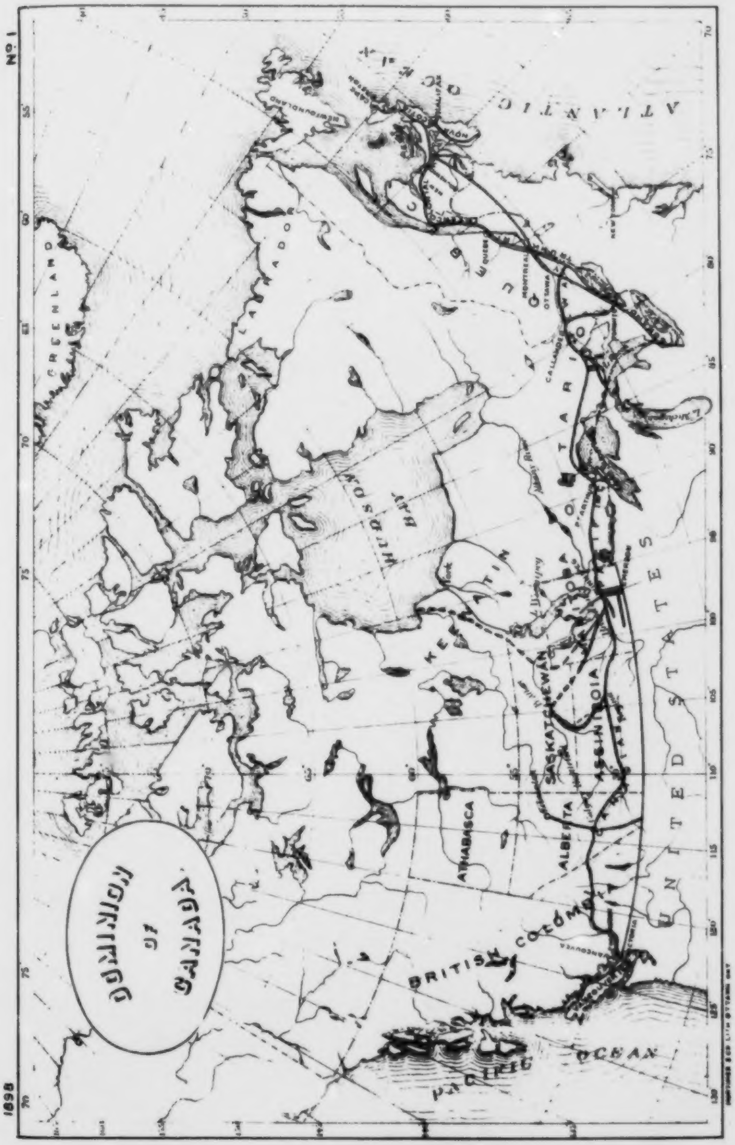
Success in passenger traffic as far as the CPR was concerned depended upon immigrants to the West and the spin-off traffic that resulted from their homesteading efforts. Between 1881 and 1914 the Prairie population increased from just over a quarter of a million to more than 1.3 million. It was the Canadian Pacific that brought most of these people westward. In the first full year of operation the line carried more than one and a half million passengers. By the early 1890s the figure had doubled to more than three million. When the wheat boom hit the Prairies at the turn of the century the numbers continued to rise, to more than four, then five, then seven million. By 1913, the last year of the boom, the CPR carried more than 12 million paying passengers.[82] To handle this traffic the railway built special immigrant cars, advertised in Europe and arranged through journeys at cheap rates. And because they owned vast tracts of Prairie land as a result of earlier grants, the railways could run a service that handled the immigrants' needs from the time they embarked in Europe until they were settled on the land. It was a nicely integrated relationship. That original passenger trip could lead to land-sale revenue, and that sale could, within a couple of years, lead to increased freight traffic as crops were exported and goods imported. Throughout the West the increasing population brought an ever larger number of commercial passengers to Prairie towns and cities. Thus the original cheap immigrant fare, profitable in itself, was repaid in many ways over the years that followed.

Obviously not all passenger traffic depended upon immigrants. In the East, where both the CPR and the Grand Trunk were major systems, the traffic was different. Most of the people using the trains were making round trips. Their trips were shorter and often involved major urban centres like Toronto, Montreal or Halifax. People might be travelling for business, for holidays or for visits with relatives. In many cases the passengers were commuters, travelling short distances from satellite communities to business in the city. Even in the West the nature of passenger traffic was evolving. In the first decades the immigrant traffic was central to Canadian Pacific's passenger totals. By the early 20th century the immigrant traffic was complemented by the more routine business and personal traffic typical of the East. Still, before World War I, immigration remained important to CPR's passenger system.

Whatever the purpose of the trip, the fact was that for the late Victorian Canadian, train travel was the norm. Thomas Keefer may have been melodramatic in his predictions of the benefits of the train, but for the public the train did have many emotional associations. It was the train that brought the settler and his family to a new life. It was the train that took relatives to visit one another, and it was the train that provided access to the outside world. The national symbols, in other words, were not remote and distant but a part of the daily rhythm of existence. Even after half a century nothing was more commonly used as a symbol of industrial progress. Only electricity, just beginning to make its appearance at the turn of the century, could even come close.

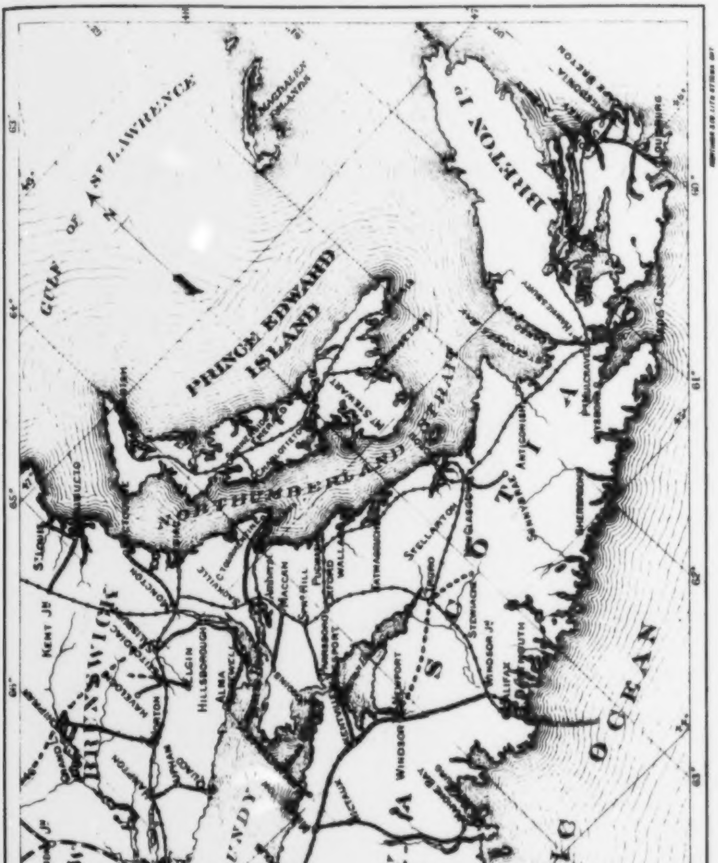
It is possible, therefore, to talk by the late 19th century of a relatively mature railway system. As Figures 3 to 6, which are reproductions of the original maps, indicate, coverage was excellent through central Canada, good in the Maritimes and, though far from satisfactory, increasing yearly in the West. The great projects of Confederation were complete, and the public already viewed their railways as an integral part of both the Empire and the nation. Government relationships to railways were fairly well established.

Figure 3
THE CANADIAN RAILWAY SYSTEM, 1896


No 1
1898
DOMINION of CANADA
GREENLAND
LABRADOR
HUDSON BAY
ATLANTIC OCEAN
PACIFIC OCEAN
QUEBEC
MONTREAL
OTTAWA
CALLANDER
ONTARIO
KEEWATIN
SASKATCHEWAN
ASSINIBOIA
ALBERTA
ATHABASCA
BRITISH COLUMBIA
UNITED STATES

**Source:** **Map reproduced from *Annual Report of the Department of Railways and Canals, July 1, 1897 to June 30, 1898* (Ottawa: Queen's Printer, 1899).**

*Figure 4*
**THE CANADIAN RAILWAY SYSTEM, 1896: DETAILS OF NOVA SCOTIA AND NEW BRUNSWICK**

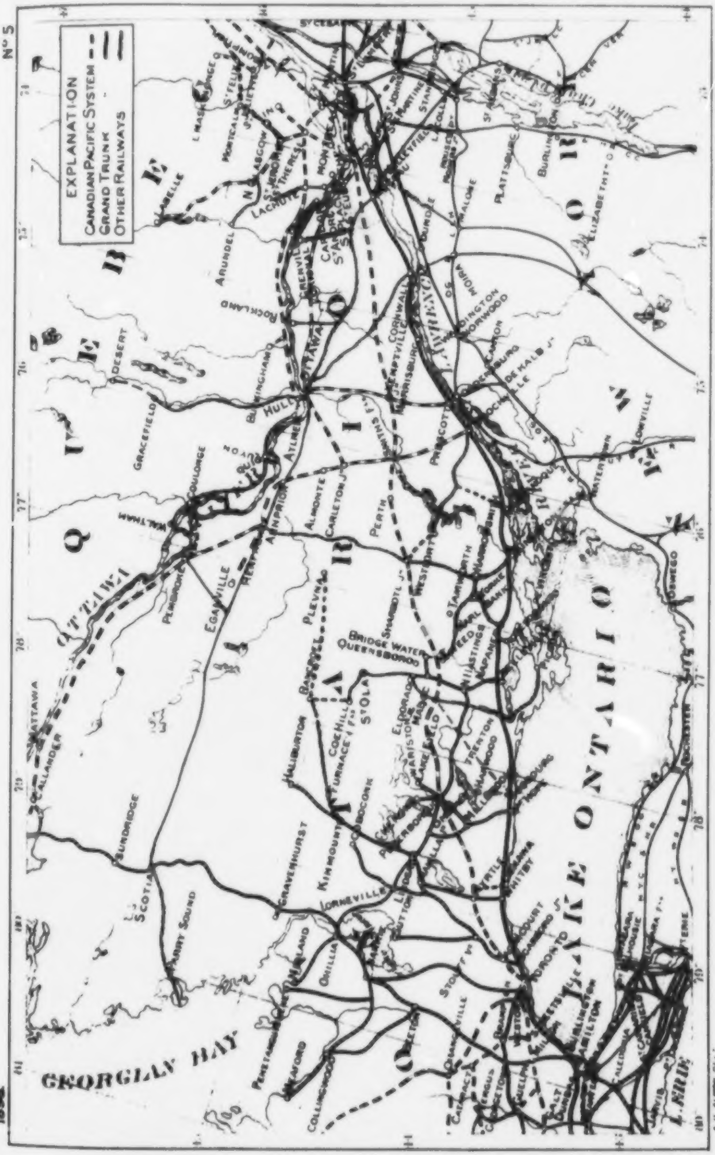


N°2
1896
GULF OF ST LAWRENCE
PRINCE EDWARD ISLAND
NORTHUMBERLAND STRAIT
MAGDALEN ISLANDS
CAPE BRETON I^D.
NEW BRUNSWICK
NOVA SCOTIA
BAY OF FUNDY
ATLANTIC OCEAN
MAINE
MONCTON
HILLSBOROUGH
ALBA
ELGIN
KENT J^N
FREDERICTON
MACCAN
WINDSOR
WINDSOR J^N
HALIFAX
DARTMOUTH
STEWIACKE
STELLARTON
NEW GLASGOW
ANTIGONISH
MULGRAVE
LOUISBURG
SAULNIERVILLE
CHARLOTTETOWN
EXPLANATION
CANADIAN PACIFIC SYSTEM
GOVERNMENT RAILWAYS
OTHER RAILWAYS

**Source:** Map reproduced from *Annual Report of the Department of Railways and Canals, July 1, 1897 to June 30, 1898* (Ottawa: Queen's Printer, 1899).

Figure 5

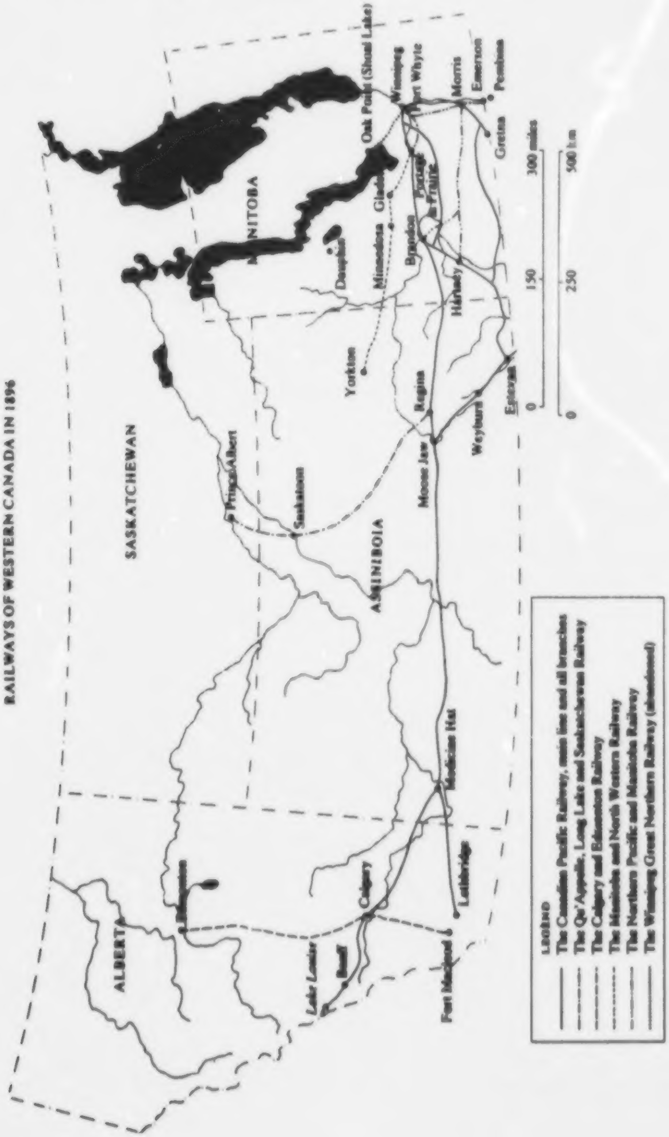
THE CANADIAN RAILWAY SYSTEM, 1896: THE CENTRE OF THE CANADIAN RAILWAY SYSTEM, MONTREAL–HAMILTON


N° 5
EXPLANATION
CANADIAN PACIFIC SYSTEM
GRAND TRUNK
OTHER RAILWAYS
QUEBEC
ONTARIO
NEW YORK
LAKE ONTARIO
GEORGIAN BAY
L. ERIE
OTTAWA
MONTREAL
HAMILTON
TORONTO
KINGSTON
1896

**Source:** Map reproduced from ***Annual Report of the Department of Railways and Canals, July 1, 1897 to June 30, 1898*** **(Ottawa: Queen's Printer, 1899).**

*Figure 6*

*The Canadian Railway System, 1896: The Prairie Railways*


RAILWAYS OF WESTERN CANADA IN 1896
SASKATCHEWAN
MANITOBA
ASSINIBOIA
ALBERTA
Oak Point (Shoal Lake)
Winnipeg
Fort Whyte
Morris
Emerson
Pembina
Gretna
Gladstone
Portage la Prairie
Minnedosa
Dauphin
Brandon
Hartney
Yorkton
Regina
Weyburn
Estevan
Moose Jaw
Saskatoon
Prince Albert
Medicine Hat
Lethbridge
Calgary
Edmonton
Lake Louise
Banff
Fort Macleod
0
150
300 miles
0
250
500 km
LEGEND
The Canadian Pacific Railway, main line and all branches
The Qu'Appelle, Long Lake and Saskatchewan Railway
The Calgary and Edmonton Railway
The Manitoba and North Western Railway
The Northern Pacific and Manitoba Railway
The Winnipeg Great Northern Railway (abandoned)

**Source:** **Map reproduced from T. D. Regehr, *The Canadian Northern Railway, Pioneer Road of the Northern Prairies* (Toronto: Macmillan, 1976), p. 22**

Governments would aid railway development, often considerably. At the same time government, whether Dominion or provincial, had generally resisted direct ownership. There were the exceptions of the Intercolonial and Prince Edward Island systems. The ongoing operational losses of the two railways, however, generally reinforced rather than challenged the Government's desire to stay away from ownership.

All in all the procedure of land and cash had not worked badly, though the landscape was littered with charters that had been abandoned and offers of land grants that had not been fulfilled. Now, as Canada began the period of greatest expansion in its history, the final great phase of railway expansion was about to begin. Ultimately this expansion would bring the old subsidy program crashing down and forced into creation a network of nationally owned and operated railways.

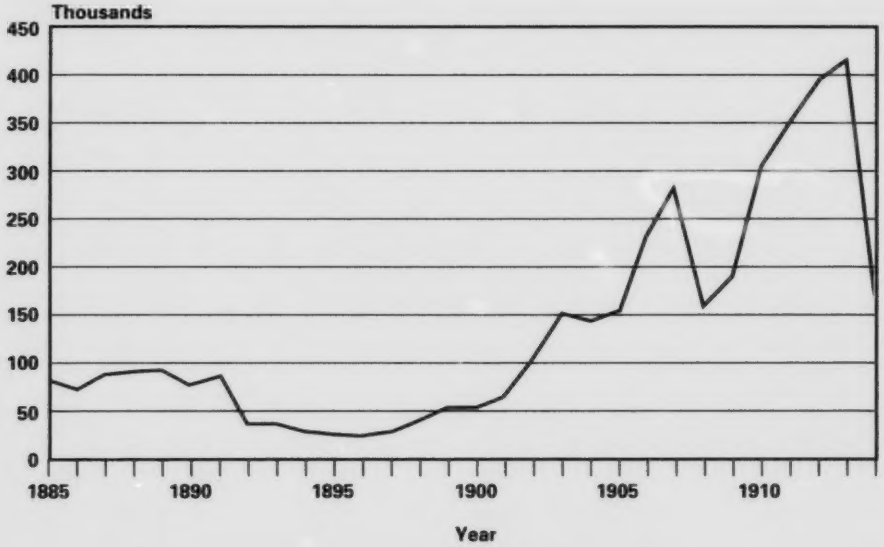
## THE FINAL PHASE OF RAILWAY DEVELOPMENT: 1897–1917

Once again the prize was the West. After 1896, international economic conditions improved. Canada, especially the West, became the destination of choice for thousands upon thousands of immigrants (see Figure 7). Higher wheat prices also provided a rapidly growing export product. Reinforcing these trends was the inflow of British capital to the region. The long-anticipated Western boom was under way, and it continued almost uninterrupted for nearly 15 years. In the 1880s it seemed foolish and daring to talk of one transcontinental railway; now it was feasible to talk of two or even three. The relative stability of the railway system was about to be shaken as the Dominion entered the third and last phase of great railway expansion.

Forces in the West and the East had reasons to want railway expansion. After two decades of CPR monopoly many westerners were disgruntled with high freight rates and with CPR caution in expanding its branch-line network. Two railway entrepreneurs, William Mackenzie and Donald Mann, responded to the disgruntlement and to the profitable charters lying around by constructing a growing pattern of local lines around Winnipeg in the 1890s.[83] By the turn of the century their ambitions had grown, and preparations were under way to expand their line, now known as the Northern Railway, eastward to the Lakehead. There was even talk of heading westward toward the Rockies. For Prairie farmers dependent on the CPR such competition was a welcome thing, and they encouraged their legislatures and the company to move forward with the plan.

*Figure 7*

***NUMBER OF IMMIGRANTS TO CANADA BY YEAR, 1885–1914***



**Source: Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series A350.**

In the East it was not regional grievances that were emphasized but the opportunity to make up for a squandered past. The Grand Trunk railway had in the 1870s refused to build an all-Canadian transcontinental line and had therefore been relegated to the sidelines as the CPR became one of the world's most famous railways and was even profitable. The Grand Trunk not only missed the opportunity to become a transcontinental but over the decades since the CPR's completion had been forced to wage an often vicious competition in the East with this upstart rival. Now the Prairie market seemed for the first time capable of supporting a second transcontinental, and the Grand Trunk was determined not to be left behind again.

Both railways followed the established pattern and turned to governments for support. The details of the subsidies, as is so often the case, are extremely complex and only of marginal relevance here. What is important is that a combination of politics, stubbornness and too much optimism meant that instead of choosing between one of the rivals for the new transcontinental line, Canada got both. Initially the Grand Trunk, along with its newly created subsidiary, the Grand Trunk Pacific, was the favoured child of Prime Minister Wilfrid Laurier's Liberal government. Large subsidies were handed out, and the Government even agreed to construct the most unprofitable portion of the line (north of the Great Lakes) and then turn it over to the completed railway. The Northern Railway refused to back off, however, and used its considerable clout in the West to gain local support, including significant grants and guarantees from provincial legislatures. Then, when Robert Borden's Conservative party took power in 1911 the Northern was able to join the Grand Trunk at the federal trough.[84]

For the next several years the two railways proceeded to build lines across the Prairies along the old Yellowhead route. By 1907 they were in Edmonton, and both were determined to push through lines to the West coast that were, in many cases, practically next to each other. Government largesse, excessive optimism and business egos led to one of the greatest bursts of railway expansion in history. Prairie mileage had tripled to some 11,000 miles (17,700 km) by the eve of World War I. Overall, by 1915, as Michael Bliss has pointed out, Canada was the nation with "more railways per capita than any country in the world."[85]

These railways had been built at considerable expense to the Canadian taxpayer. As a matter of pride and public relations the railways sought to capture the public imagination as the CPR had done. The Northern Railway had the more authentic claim in this regard. With some justification it portrayed itself as the corporate entity that would finally rescue the western Prairies from CPR monopoly. This was the "West's own railway," which by its very existence would force the CPR to be more competitive in rates.[86] This belief was important both in the political support the Northern gained during its rapid expansion and in the considerable financial support given to it by western provinces like Manitoba. If the CPR capitalized upon the ideal of national unity, the Northern capitalized upon a sense of regional grievance.

The Grand Trunk and Grand Trunk Pacific had a more difficult time attaching themselves to the romance of Canadian railroading. The railway did have a positive image for good service in the East. It was an unknown in the West, however, and the seemingly rich deal it struck with Laurier's government to compete with the Northern did not endear it to Westerners. The railway's managers did take a leaf from the CPR and supported a book extolling the virtues of the project. Its author looked to the imagery of both the Northern and the Canadian Pacific and made up in rhetoric what the Grand Trunk Pacific lacked in historical tradition. The Grand Trunk Pacific would take on the CPR, which "wielded its power in an autocratic manner." Once completed the "farmer would no longer be at the mercy of a railway octopus." The people who accomplished such works were, of course, heroes:

> When the Epic of the railway is written, the men who laid the foundations of the National Transcontinental will loom prominently therein. . . . They were not communicative; hardship, privation, peril, and sensational excitement had been encountered so frequently that they considered such a part of the daily round, and now that they could view them from afar, and a more distant date, they made light of them. But when I probed beneath the surface, as seated round the blazing fire in the lonely camp in the wilderness I drew them into conversation, and once more threw them back into the days when they were up in the forest toiling mighty hard to find that four-tenths of 1 per cent grade, they grew slightly reminiscent. And what stories they could tell! What thrills they could give![87]

Despite this author's enthusiasm, the "Epic" was never written. The Grand Trunk railway, though extremely well built, was never able to assert a romantic public image. Even the Northern, though supported by Westerners initially, found its own image floundering within a few years. For what these two railways conjured up in the public mind was not the romance of construction or even the opening of new districts but the sheer cost. Indeed, their experiences shifted the whole image of the railway in Canada generally. Before the new transcontinentals were built the public still revelled in the Victorian imagery of the railways as a symbol of progress and technological triumph. The expectation was that railway construction and expansion were a part of Canada's future. Even among Westerners who distrusted the CPR, for example, there was a continuous clamour that that railway build new branch lines. After the experience of the new transcontinentals the image shifted. Railways became associated with their costs as much as their results. The excesses of the early 20th century meant that henceforth both public and political attitudes to railway development would be much more cautious, even negative.

What happened in the interval is extremely complex. The business affairs of the Grand Trunk and Northern were a massive tangle of land grants, Dominion and provincial government arrangements, bank loans, share issues and holding companies. Amidst all the confusion, however, the story is actually fairly straightforward. First, the railways and the Government overestimated the ability of the nation to support a massively expensive new transcontinental line. Certainly they overestimated its ability to support two such lines. Second, the Government found itself drawn into the same sort of position it had experienced with the canals three quarters of a century before. Loans, subsidies and especially loan guarantees made the Government hostage to the railways. Even before World War I broke out, for example, the Dominion government had acquired some $40 million in Northern Railway stock, and that was only a fraction of the amount they had loaned out. The railways simply could not be allowed to go under. This was especially true because at least one province (Manitoba) and one bank (Bank of Commerce) were so heavily committed to the railways that their bankruptcy would have followed that of the railways almost immediately. Third, this overextension of resources was made much worse by World War I. A wartime economy pushed prices up rapidly. The costs of supplies, of locomotives and of labour all increased. At the same time the traditional source of foreign capital, the London money market, dried up in the face of wartime demands at home. By 1915 the Northern was effectively bankrupt. The Grand Trunk Pacific was not far behind.[88]

The Government sought answers to the chaos through a royal commission.[89] The Drayton-Acworth Commission was split ideologically. One faction hoped that a merger of the two railways might allow a continuation of the system in private hands. The other side, and ultimately the Government as well, saw this as unrealistic. The fact was that most of the railway funding, to the tune of a quarter of a billion dollars, was tied to government support.[90] To put this in perspective, the total revenue of the Canadian government on the eve of the war had been only $169 million. At the provincial level, British Columbia had guaranteed $40 million of Northern debt, and Manitoba had guaranteed $25 million. The annual revenues of the two provinces were, respectively, $10.2 and $4.1 million (1913 figures).[91] There was thus no real choice. The federal government decided in 1917 to nationalize the two railways.

The nationalization process was almost as complex as the financial freewheeling that made it necessary. It was 1923 before the Government railways — the Prince Edward Island Railway, Intercolonial, Grand Trunk and Grand Trunk Pacific, Northern, as well as smaller railways — were formally amalgamated into the Canadian National Railway (CNR) system.[92] The Canadian government, which had for so long resisted any massive ownership of railways, now possessed nearly 22,000 miles (35,400 km) of track and a massive corporation, spanning a continent and employing nearly 100,000 people. It had also assumed a massive debt and, in a controversial move, put that debt on the books of the new Canadian National corporation. Thus CNR began life with long-term debts of nearly $2 billion! This made deficits inevitable, and these would be a harsh reminder of the nature of its birth. "The mood of the time in which Canadian National Railways were born was more critical than sentimental; more conscious of the burden that was to be carried than of the ambitions that had been foiled; more censorious of the sins of the fading companies than proud of the achievements they had made."[93] The Canadian railway system was, to all intents and purposes, complete.

## 4. THE "MATURE" RAILWAY SYSTEM AND THE RISE OF THE CAR CULTURE: 1900–1945

Now that the railway system was in place, what did it mean in terms of passenger service? How much was the railway a part of the everyday life of the Canadian? In general terms, the railway network, so overbuilt from a financial point of view, gave the public good access in most settled parts of the nation. In the cities and larger towns, conveyance to the solid brick or stone railway station could often be made by public vehicle. In the larger cities street railways ran regularly along major thoroughfares. The traveller could therefore leave a house in Toronto, Montreal or elsewhere, walk to the corner and catch a street railway to the railroad station. Many passengers took their horse and buggy or, occasionally, went in the new device, the car. Outside the cities, of course, private transportation was all that was available.

In city or country, however, the destination was the train station. For it was there that connections to the outside world were made. In an era before competition, the station combined the role played by air terminal, bus terminal and, of course, train station today. As the architecture of Union Station in Toronto (completed 1927) indicates, the stations themselves were opulent affairs, reflecting the power and substance of the railway's dominance over the nation's transportation network. The stations were, as the slogan of the time had it, "the crossroads of commerce."

This was more than an idle boast. The major stations were central to business and personal travel. At the major stations scores of trains departed daily.

Once in the station the passenger had access to the continent. Complex routings along different lines and different railways created a wide variety of choices of routes, destinations and levels of comfort. Indeed, the complexity and variety of the turn of the century timetables are more than normally striking for the contrast they present to the current atrophied state of passenger rail service in North America. Also striking and occasionally forgotten amidst the nationalist symbolism was the vast amount of railroad service to the United States. The Canadian Pacific and Grand Trunk both had regular service to all northern U.S. centres. For more distant points they provided transfers and through connections via U.S. lines.[94]

The passenger taking a long trip also had a number of options for sleeping accommodation. The Pullman sleeping car, developed in the United States, was widely used. Canadian Pacific even boasted that it had improved the Pullman and provided comfort superior to that of any U.S. line. The sleeper was also available in a series of classes. First class was a luxurious service, designed to attract the affluent family and business traveller. The tourist sleeper was less ornate but was only about half the cost of first-class accommodation. There was also the colonist sleeper, though the average intercity traveller was unlikely to use or even see this accommodation.[95] It was really designed for the special immigrant trains that had been so important before World War I.

Also, well before the 1920s, dining cars had become common. Earlier it had been normal for railways to schedule station stops so that passengers might eat — much as bus lines do today. Some of the CPR's first hotels in the Rockies, such as Mount Stephen House, were in fact way stations. The schedules did not leave people much time for a leisurely lunch. Twenty-minute to half-hour stops were considered adequate.[96] Such tight timing led to discomfort for passengers and undoubtedly delays for the crew. By the

20th century, however, the well-appointed dining car was one of the features expected by first-class passengers. These cars rarely made money for the railways, but they were a necessary service if railways were to compete. On longer trips and the most important lines, therefore, dining service was regularly available.

There were some alternatives to trains. On the Great Lakes and along the British Columbia coast, travellers could take steamships, many of them owned by CPR and integrated into train schedules.[97] For other trips people could simply travel by horseback, carriage or car. Such individual travel is impossible to measure, but over long distances it was certainly an inferior means of getting about. Nothing, however, could compete with the train, which completely dominated both commuter traffic and the long haul. In 1920 there were six train trips taken for every man, woman and child in Canada.[98] Fifty years later it was less than one — and the relative cost of train tickets had decreased in the interval. In the years between the turn of the century and the Great Depression, the normal business or personal traveller almost certainly took the train to travel between cities.

To maintain their dominant position after the war, however, the railways did have to develop new strategies. Before World War I, as has been discussed, two types of passenger predominated: the local commuter (mainly in Eastern Canada) and the immigrant. Though the train was a part of the rhythm of life, it was also a means to other unrelated activities — settlement, business or visits. By the 1920s, however, there were growing concerns about the future of both kinds of traffic. Most of that concern was focussed on the apparent end of massive immigration to Canada. Before World War I, immigration had reached historic highs, averaging more than a quarter of a million people a year. Naturally, the war brought a precipitous decline: immigration reached a low of 36,000 in 1915. More significantly, the recovery after the war was incomplete. The days of the "last best West" as a major destination for immigrants was over. Canada's primary agriculture frontier was now taken. This, combined with more restrictive rules, meant that half as many immigrants came to Canada in the 1920s as before the war. With a larger percentage of these staying in the urban areas of the East, immigrants could not provide the staple passenger traffic for the railways that they once had.[99] If the immigrants weren't coming in as great numbers, however, the railways hoped that the tourists would. In the 1920s the railways put a major effort into attracting the lucrative tourist dollar.

Tourism was not new to the railways. From the beginning the Canadian Pacific had made efforts to draw tourists to the West. Passenger agents in London and the United States, although concerned primarily with immigrants, distributed promotional pamphlets emphasizing the grandeur of the scenery and the comfort of the railway.[100] William Van Horne himself liked to make up advertising slogans, though they were noted more for their unusual nature than their staying power. The railways also gave free passage or other support to well-heeled travellers who intended to publish their experiences.

From the beginning the railways had tried to sell more than mere railway fares to tourists. As land sales attracted immigrants, so an integrated CPR package could attract tourists. By 1886, one year after the railway opened, there were three hotel dining stops in the mountains.[101] The next year, with the active encouragement of the CPR, Banff National Park was created by the Dominion government. The CPR quickly built a hotel on the site, and in 1888 the first version of the Banff Springs Hotel opened for business. By 1891 it was receiving more than 3,000 guests a year, almost all arriving by railway. Over the next decades the network was improved and extended. The "Chalet" Lake Louise (1890)[102] and Hotel Vancouver (1887) reinforced the network of hotels and emphasized the fact that tourism for the CPR increasingly focussed on the mountains. By the turn of the century the fare-paying passenger had an annotated timetable to describe local sites, several luxurious hotels at which to stop over, and possible side trips and excursions at various points along the way. There were also 115 sleeping cars to cater to the luxury, largely tourist, trade.[103]

All of this paled next to the efforts of the 1920s. The two railway companies made massive investments in the tourist industry. As one historian has said, "the hotel and resort war that took place in the later twenties cannot be explained by rational projections of expected profits."[104] It can be understood, however, by realizing that for the first time two complete transcontinental systems sought supremacy. Each resented the other, and both were led by determined, energetic individuals. Accordingly, millions of dollars were spent on constructing or renovating hotels still familiar today: the Bessborough in Saskatoon, the Nova Scotian in Halifax, the Chateau Frontenac in Quebec City and the Chateau Laurier in Ottawa. And in Toronto, Canadian Pacific built what was supposedly the largest hotel in the British Empire, the Royal York.[105] At $16.5 million it cost more than the annual revenue of six of Canada's provinces! Of course these hotels were for business travellers as well as tourists. They were also a part of the railway's image, an image that would be increasingly difficult to maintain when the Great Depression hit within a few years.

Despite all these expenditures, the railways continued to focus their efforts for the tourist dollar in the mountains. By the 1920s the earlier facilities at Banff and Lake Louise had grown in size and splendour. To the north the Canadian National Railway built Jasper Park Lodge (1922). Along the CPR route through Banff, detailed guidebooks were available. These not only told you of the sites to be seen but all the activities that could be arranged as a part of your trip. Some of this was tremendously organized. It was possible, for example, to detrain at Banff, meet a prearranged guide, tour Banff, travel to Lake Louise ("a fire proof and modern hotel with accommodation for seven hundred guests"), spend the night there, get up in the morning for a motor trip to Emerald Lake and then go on to meet the train. The cost was $18.50.[106] Side trips were also possible at various sites in British Columbia.

Around the major cities of the country, railways provided another type of tourist service. From the 1890s on, the growing urban population of Canada, especially in Ontario and Quebec, had begun the ritual of escape to cottage country. Private cottages or resorts dotted along the Laurentian and Muskoka lakes created a lucrative market for trains. Even by the early 1920s cars were still relatively rare and a 100-mile (160 km) trip enough of an adventure that the trains captured a good deal of the trade. By the end of the decade, however, the car was beginning to have an effect on this trade.

Tourism was important not just for the railway revenues but for the way in which it further integrated the railways into the life of Canadians. Earlier sightseeing and adventuring across the wild West had now been replaced by a more sedate, widespread and family-oriented tourist trade. The grand railway hotels added to the glamour and romance of the railway system. The railways accordingly became associated with both the Canadian landscape and Canadian social activities — whether dining in the major urban hotels or backpacking in the Rockies. All of this added to the belief in the importance of the railway passenger system to the country as a whole.

Tourism and the increasing travel of the urban business class made the 1920s generally good years for the two major railway systems. Freight revenue was high, but so too was passenger traffic. In 1920 more than 50 million passengers were carried on the railway system, an all-time high. Throughout the 1920s numbers well in excess of 40 million were common. Moreover, revenue for passenger traffic per train-mile increased in real terms throughout the 1920s. Overall, passenger revenue was an important part of the earnings of both CPR and CNR. In 1925, for example, CNR earned 19 percent of all revenue from passenger fares.[107] In contrast, 40 years later it would be 7 percent.[108]

The importance of these revenues was reflected in the service. Both major railways had more extensive passenger schedules in the 1920s than they had before or would after. The tourist who wanted to go westward from Calgary to Vancouver, for example, had a choice of four trains daily.[109] By the end of the decade the CNR had inaugurated a train that travelled from Toronto to Montreal in six hours. Even on the less popular runs the service was impressively complete and efficient. Many trains stopped at literally hundreds of communities while wending their way from one major centre to the next. Moreover, though major new routes were not opened in the 1920s, there had been continued construction of branch lines, especially on the Prairies. Thus despite of some closures and rationalizations resulting from the collapse of the Grand Trunk and the Northern, railway mileage in Canada increased by some 3,000 miles (4,800 km) in the course of the decade.[110] By that point most communities of any size in Canada outside of the North had access to a railway. At the end of the decade the train remained the common means of travel and a part of the ordinary daily routine and the special occasions of Canadians' lives. The railways remained king of passenger conveyance and passengers remained important to the railways.

## THE RISE OF THE CAR CULTURE AND ITS CONSEQUENCES: 1900–1929

Even as the railway system matured a new technology was rising to challenge the dominance of the railway. In the 30 years after the turn of the century the car would revolutionize Canadian life. Government attention would turn increasingly from the overbuilt and expensive railway system to roads. The public itself, though far from abandoning the railway, found the car's flexibility and privacy tempting. Though another generation would pass before the car overwhelmed the railway as a vehicle for passenger service, the changes that took place within a generation were, nonetheless, spectacular.

At the turn of the century the car was still a toy, owned by only a handful of Canadians. Indeed, the first Canadian car would not be built until the next year. None of the legal structures, roads or governmental financial systems were designed with any thought of the car. There were no licensing provisions. In fact there were no rules at all except those that could easily be borrowed from statutes aimed at horse and carriage. In one generation all this changed. After the turn of the century the car became an increasingly common sight on Canadian streets. By 1914 there were more than 50,000 vehicles registered in Canada.[111] In the 1920s ownership exploded, turning the automobile into an everyday form of transportation for millions of Canadians. By the end of the decade Canada had the second highest per capita ownership of motor vehicles in the world, more than double the rate of the United Kingdom or France. The legal, cultural, governmental and fiscal structures of the nation had had to adapt to this new technology. Along the way the basic form of the modern Canadian road system and road policies emerged. Sometime in the period between 1900 and the later 1920s the car became a fundamental part of Canadian transportation.

There was no single inventor of the automobile. Rather, from the time of the industrial revolution people had tried to harness motorized power to the carriage. It was not until the 1890s, though, that the car was distinguishable as a new vehicle, though the technology remained primitive. Shortly after the turn of the century cars were numerous enough that laws began to appear on the books to deal with them. This was especially necessary in the United States, which was rapidly becoming the world's most motorized society. As early as 1901 New York State passed driving regulations and laws, and by 1905 most states had speed limits.[112]

Canada was not far behind. Like the United States it had a prosperous population with large disposable incomes. Canadians also had obvious reasons for being interested in improvements in transportation, given the size of the country. Also, except for a few areas, Canada was thinly settled and that meant that fixed forms of transportation like the railway could not possibly serve every community. A land vehicle freed from the track but able to achieve relatively high speeds possessed great potential for a geography like Canada's. Thus, living next to the United States, prosperous in its own right and with a real need for transportation innovation, Canada soon followed American footsteps into the automobile market.

The first Canadian car was built in 1901 by the T. A. Russell Company. Before long other entrepreneurs and innovative carriage makers followed suit. A competitive and as yet only loosely formed auto industry soon developed, mainly in Ontario. Ontario was also the province where the car was first seen with any regularity. In 1907, the first year for which statistics of car ownership are available, Ontario accounted for more than 70 percent of cars nationwide. Outside of the Windsor–Montreal corridor and the Vancouver–Victoria area, car ownership was still extremely rare. Only in this corridor were there sufficient wealth, population and, not incidentally, passable roads to encourage any sort of car ownership.

Even at this early date, however, the rise of the car had forced governments to respond. Ontario passed a registration provision in 1904, and within a few years other provinces followed suit.[113] New technology also brought new rules of the road. The car operated at high speeds compared with horse and carriage, and this created concerns about safety. Accordingly, it was not long before traffic violations and traffic accidents became an item of concern. Speed limits (usually 15 to 25 miles per hour (24 to 40 km/h)), regulatory codes and lists of fines and punishments became necessary. Only in Prince Edward Island was all this legislative activity muted. That province resolved the whole issue by prohibiting motor vehicles outright. Even when, in 1913, it decided to allow motor vehicles the province was hardly enthusiastic. Driving was banned Tuesday, Friday, Saturday and Sunday. Perhaps it is not surprising that the province had a mere 31 cars by the beginning of World War I.[114]

As society came to grips with the new technology, auto makers continued to improve their craft. Companies collapsed and new ones arose. Giants like Ford and Buick and Oldsmobile began to take a larger share of the market. The open car gave way increasingly to the closed one — a very practical development given Canadian winters. Air-cooled engines gave way to water-cooled ones. Steam engines yielded to gasoline engines. Horsepower increased, and at the top end of the market considerable elegance was possible. There was also tremendous development of ancillary industries. Parts became increasingly available, as did gasoline and service.

Most important of all, however, was the arrival of the relatively cheap and reliable car. In 1905 the average price paid for a car was in the neighbourhood of $1,784, or about 18-months' salary for a middle-class white-collar worker.[115] Then, in one of the events that has become a legendary myth of industrial history, Henry Ford revolutionized production and design to produce the famous Model-T in 1908. Powered by a four-cylinder, 20-horsepower gasoline engine, the Model-T provided reliable transportation for $850. By the early 1920s up to a million Model-Ts were being sold every year in North America. Other companies quickly adjusted or, if they did not, sank into bankruptcy. By the 1920s several cars, such as Chevrolet, could reasonably claim price parity with the Model-T and superiority in design and comfort. The Model-T and its direct competitors made the car available to the middle class.[116]

These innovations accelerated the rate at which car ownership increased in Canada. As Table 1 indicates, the number of Canadian-owned vehicles in 1907 (2,130) had increased tenfold to 21,519 by 1911, and this number had more than tripled (69,598) by the beginning of World War I. Also, ownership had spread more evenly through Canada. Ontario drivers then owned less than a third of Canadian vehicles, and even Prince Edward Island had eased its anti-car position by World War I. As we saw above, it possessed 31 vehicles. The car had become a national institution.[117]

*Table 1*
AUTOMOBILE REGISTRATIONS, 1907–1929

| Year | Number | Year | Number | Year | Number |
|---|---|---|---|---|---|
| 1907 | 2,130 | 1916 | 123,464 | 1926 | 728,005 |
| 1908 | 3,033 | 1917 | 197,799 | 1927 | 836,794 |
| 1909 | 4,763 | 1918 | 275,746 | 1928 | 945,672 |
| 1910 | 8,967 | 1919 | 341,316 | 1929 | 1,070,664 |
| 1911 | 21,519 | 1920 | 407,064 | | |
| 1912 | 34,136 | 1921 | 465,378 | | |
| 1913 | 50,558 | 1923 | 513,821 | | |
| 1914 | 69,598 | 1924 | 586,850 | | |
| 1915 | 89,944 | 1925 | 652,121 | | |

**Source: Statistics Canada (formerly Dominion Bureau of Statistics), *Canada Year Book*, 1933, p. 686.**

The real boom was yet to come. In 1918 the Mayor of Hamilton, surveying the likely demands of the post-war world, warned "This is not the time of railroads, but this is the time of good roads, and it is the time of automobiles. The traffic conditions have absolutely changed during the past few years."[118] Despite the recent collapse of the Grand Trunk and Northern it was far too early to sing the death knell of the Canadian railway. Nevertheless, the Mayor had recognized an important point. The post-war world was car crazy. Even in 1921, when a vicious slump devastated many sectors of the Canadian economy, both automobile registrations and production continued upward! The Mayor was right. The time of the car had arrived.

James Flink, in his assessment of American automobile development, uses the term "car culture" to emphasize the pervasive influence the automobile has had on modern life. The car, Flink argues, "more profoundly influenced twentieth-century American historical development than the collectivity of reforms emerging from the so-called Progressive Era and the New Deal combined."[119] At some point the car became a sufficiently powerful presence that society began to revolve around it in myriad ways — from town planning to advertising to the economy. Thereafter nothing would ever be the same, and the arrival of the car culture, as much as World War I might be taken as the true end of the 19th century.

For Canada the car culture arrived in the 1920s. Whether judged by the diffusion of the technology, form of production or supporting infrastructure, the 1920s was a watershed decade for the car in Canada. The number of registrations rose to more than one million, and the number of persons per car dropped from 30 to 10. Throughout the decade registrations increased at an average rate of well over 10 percent a year. At the same time the horse declined in numbers for the first time since statistics had been kept. It would not recover.[120] On the production side, automobile manufacturing underwent a major series of consolidations, including the collapse of the last independent Canadian manufacturers by mid-decade.[121] It was also in these years that many of the modern distribution, marketing and advertising techniques associated with the car came into being. The development of the car culture also saw the formation of a more effective infrastructure. Automobile clubs, which had been irregular and largely local before the war, were expanded and organized. Likewise, anomalies in driving regulations (such as left-side driving) disappeared. Only one out of 10 Canadians may have owned a car, but the values of the automobile, its appeal to people and therefore its demands upon governments were far greater. The car culture had become a way of life.

The modern image of the car is ambivalent. Traditional images of romance compete with fears of pollution and safety. So it has been from the beginning. Carriage drivers protested against the fright to their horses caused by the noise and speed of cars. The absence of driving tests and the basically dangerous nature of the vehicle quickly made traffic accidents an issue. Given these decidedly mixed reviews, the striking thing is the hold the car had on imaginations, even by the 1920s. This was not just a new appliance such as, say, the electric range, but a new experience, and the imagery of that experience must be understood if the place of the car in 20th century Canada is to be understood.

There is a fact that precedes the mythology, however. The automobile was an improvement over the horse, not just in personal but in social terms. The concept of *The Horseless Age*, as one American automobile journal was entitled, was appealing for many reasons. When the car was introduced it appeared to possess considerable sanitary and social advantages over the horse. The horse was an animal and that created obvious problems. In New York City, for example, about 1,250 tons (1,130 tonnes) of horse manure was removed each year. There were also thousands of horses found abandoned or dead by city officials annually. Both the refuse and the carcasses created horrendous odour and health problems. Horses also got ill, often with infectious diseases that threatened surrounding animal life and caused suffering for the animal. At least when a car broke down it did so in mechanical solitude. In sum then, the automobile was "cleaner, safer, more reliable and more economical than the horse."[122]

The image of the car has never rested on such mundane matters as health and economy, however. Practically from the beginning, enthusiasts attached a whole host of values to the car. Before long it had developed a mystique of its own. Sometimes this mystique could be expressed in terms as romantic and all-encompassing as those used by early promoters of the railroad. Chevrolet advertised its cars under the banner headline, "What Transportation Means to Civilization." Civilization, it determined, was the result of the interchange of individual thought, "and that thought could only be exchanged if transportation was available." The car was the superior form of transportation because "it is not limited to mass movements nor [sic] fixed routes" but could penetrate everywhere. It was, accordingly, the great civilizer of the modern age.[123] This was a common theme in the advertising, but it was far from restricted to advertising. W. H. Dandurand of Montreal, one of the foremost early car enthusiasts of Canada, sounded reminiscent of 19th century railway philosopher Thomas Keefer as he described what improvement of a highway did for the region south of Montreal: "The schools are kept in good shape, the children are better dressed, the little girls wear new dresses and all the children wear boots. . . . Last year we noticed that they had flowers on their lawns and that they had real lawns on which they used lawn mowers and kept the grass nicely cut."[124] All this because the car could now readily traverse the area.

Such hyperbolic rhetoric points to an important theme of the age. This was a time of rapid urbanization. People feared that the movement to the city would undermine a moral fabric that, it was believed, rested in the countryside. The car provided a partial remedy to the problem. Rural families might be less tempted to throw their lot in with the cities if they were less isolated. The car provided an easy access from farm to city. On the other side, those who had already cast their lot with the city might at least escape the oppressive weight of concrete and brick to return to the countryside. Henry Ford summed it up with the comment "We shall solve the city problem by leaving the city."[125] The President of the University of Toronto, Robert Falconer, said much the same thing in 1915: "Is it not going to be possible to get people from the cities out into the country? Is it not possible to relieve the pressures of the cities?"[126]

These broad social values only indirectly translated to a personal appeal to the would-be car buyer and driver. In selling the car, advertisers used themes of status, taste, refinement and culture. Many of the themes would still be familiar today. A 1929 advertisement in *Canadian Motorist*, for example, portrayed a chic, modern woman standing beside the newest Hupmobile. "Sports ensemble by Regny. . . . Car by Hupmobile," ran the ad. An Essex Super Six sought to convince prospective buyers that they were conforming to popular taste, referring to "this country and world-wide conviction" about the quality of the car. Yet another ad — this one from an American publication — reassured potential buyers that to consider the 1921 Liberty put them among those "whose taste and means incline them to better things."[127] Such imagery was part of the new advertising culture that had developed in the years since the turn of the century. Indeed, the car and modern advertising grew up together, each reinforcing the other's hold over the public. The concept of being smart and elegant was used to sell everything from furniture to cigarettes. There were also aspects of the car that, though played upon by advertisers, were closer to the real mystique of the vehicle.

Central was the idea of independence. This was your personal vehicle that could take you where you wanted when you wanted. In dozens of advertisements and articles the theme of independence was promoted in myriad ways. To a surprising degree, women were depicted as the driver of the automobile. The message conveyed by those ads seemed to emphasize several things, all related to independence. The ads implied that it was easy to operate the car and that the modern woman need not fear this new technology. Any woman could do it. This was no small matter to a generation of women who, born and raised in cities, had increasingly less knowledge and skill in horsemanship. It was also a message not lost on the urban man who, though less willing to admit such things, was himself less skilled with the horse than his forefathers had been. "It's a man's car but it's a woman's car in the sense that it's so easy to operate," said an Overland ad in the early 1920s.[128] The image of the woman driver also linked the car to the modernity of the 1920s. The old Victorian days were gone. A woman who had access to a car wasn't dependent on some man but was free to go about her business. So efficient was the car, moreover, that family duties need not be forsaken in doing so. There was adventure to be had out there beyond the world of the family and the confines of the home. The car provided the means to discover it.[129]

The advertisements emphasizing independence were so powerful because they reflected a genuine public view of the car. Articles on motoring in the early years focussed less on mechanical attributes and speed than today's magazines and more on the romance and adventure of touring. The car was a vehicle that freed the individual from the fixed lines of the railroad and opened up whole new areas of countryside. Driving was still sufficiently new and the countryside sufficiently uncluttered by other cars that there was a real sense of adventure to motoring beyond the city. People, in the words of one article, became "Knights of the Road" heading out to to see what could be seen. Trips to the end of the road in Cape Breton or into the Rocky mountains were portrayed in 1929 in terms that are associated more with modern backpacking than with motoring in the 1990s.[130] The car was flexibility, independence and adventure rolled into one. A 1929 advertisement entitled "Beyond the Barriers of Everyday" caught the mood perfectly. The picture was of a family having a picnic in a wild, wind-swept setting reminiscent of a Group of Seven location. The father stands in the centre of the picture as if guarding the situation while a very lavish picnic is spread about. "Break down the barriers of everyday," the ad read. "There's happiness ahead. . . . The outstanding Chevrolet is the magic carpet that lifts us far beyond the barriers of everyday life. The joys that lie round the turn of the road or over the hill. . . . You too, can seek and find them in your Chevrolet."[131]

The growth and development of Canadian roads must be set against the popularity of the automobile. Cars need roads, and it more or less followed from this that car enthusiasts were road enthusiasts. As the car became a part of Canadian culture the demand for roads grew. The translation of this demand into policy during the first generation of car ownership was extremely important. For by the late 1920s the whole complex set of lobby groups, policies and taxes that shaped roads in this country was in place. So too, to a surprising degree, was the modern Canadian road system, at least in embryonic form.

Support for improved roads predated the car. By the late 19th century both urban bicyclists (a new craze) and rural agriculturists were dissatisfied with the state of Canadian roads. Moreover, this was an age of reform — interlocked groups of social reformers were advocating everything from temperance to better sewers. Amidst the reformism there was, as well, social insecurity.[132] Farmers in central Canada in particular were nervous about the future as an increasing number of their children headed into the cities. Industry seemed poised to replace farming as the most important economic sector in Canada. Rural Canadians were an important force, however, constituting some 70 percent of all Canadians in 1891. They were determined to preserve their position in the community. New parties sprang into existence. Various campaigns sought to bring the benefits of the city to the countryside, hoping thereby to remove the temptation of the city. Over the next few years rural telephone systems and rural electrification would become major issues. Improved roads fit nicely into this program. Improvements would presumably reduce transportation costs and thus improve the farmer's standard of living. They would also reduce the isolation of the farm family and, it was hoped, lessen the attraction of the city.

Still, compared with the massive support of such movements as temperance, a small meeting at the Canadian Institute in Toronto on February 9, 1894 did not seem very significant. Indeed, Andrew Pattullo of Oxford County opened the meeting with the comment that "the attendance will not be very large this morning," and he apologized for the absence of any important political figures. It was in this unlikely atmosphere that the Ontario Good

Roads Association was formed, and the date is as good as any to mark the turn-around of the Canadian road system.[133] For despite Pattullo's deprecatory comments, the good roads movement in Ontario received a significant amount of attention. Cabinet ministers and senior government officials regularly attended. Before long good roads associations sprang up in other provinces. By 1914 F. H. Dandurand of Montreal had successfully formed a Canadian Good Roads Association. In 1917 it was chartered by the Dominion Parliament.[134]

The good roads movement was begun by farmers. Initially, farm associations and ministers of Agriculture showed the greatest interest in it. It was the rise of the car culture, however, that turned the good roads movement into a national cause. Moreover, the movement, though very much the outgrowth of the era's reformism, was unique in the way it blended politics and science. The annual meetings were combinations of technical discussions of road building, discussions of motoring activities and political rallies designed to impress government and public both with the need for better roads. The associations also became significant political forces. From the beginning they attracted the attention of provincial governments. In 1915 (the first year the national proceedings were published) a combined Dominion-Ontario meeting in Toronto showed that the elite members of society had recognized the importance of good roads. The Mayor, the President of the University of Toronto, provincial civil servants and government ministers all attended. It was thus no exaggeration when the Ontario Minister of Public Works concluded that "You have laid the foundation by creating a public opinion" on the matter of roads and that as a result the principles are no longer debated. It is a question of "devising ways and means to meet the different situations."[135]

In 1915 the car was not yet a mass phenomenon. After World War I the car culture took hold, and so too did the Canadian Good Roads Association (CGRA). In 1920 the CGRA held its annual meeting in Winnipeg, the first one held outside of central Canada. Through the 1920s newspapers carried extensive coverage, and the old central Canadian organization was increasingly a national one. In 1925 the Governor General, Lord Byng, attended its annual banquet, and national as well as provincial figures clamoured to be associated with the organization. The attraction of the movement reflected both the public mood and the prestige of a lobby association that was dedicated to the scientific improvement of the Canadian road system.[136]

Paralleling the good roads movement were the provincially based motor associations that would eventually evolve into the Canadian Motor League. A U.S.-inspired network of non-elite associations of local automobile clubs dedicated to the promotion and assistance of "automobility" soon took root. The development of these associations varied considerably from province to province. By World War I the Ontario Motor League was a well-established body with connections to both the Ontario Good Roads Movement and the government. In other provinces a provincial body was still well in the future. It was 1926, for example, before the Alberta Automobile Association came into being as a result of the merger of local clubs.[137]

Like the good roads associations, the motor associations became lobby groups. As early as 1915 the Ontario Motor League was instrumental in arranging a reciprocal licence agreement between Ontario and New York State. Previously drivers had to buy a New York licence plate before they could cross the border.[138] Interprovincial and international reciprocity soon became the norm, thus extending the horizons of the car driver and the potential of the tourist industry. Other campaigns followed, including one to get all Canadian provinces to have motorists drive on the right. As the automobile numbers increased the motor associations also campaigned for more traffic safety. The motor associations also collaborated with and supported the good roads associations that had grown up in various provinces.[139]

There were differences in the evolution of the two types of associations, however. The good roads associations quickly developed a technical interest, and the problems of road construction as much as government policy became their focus. Also, the various provincial good roads associations were, by the 1920s, overshadowed by the national body. In contrast the automobile associations had always had a "facilitation" role. They were the clubs of the drivers, and therefore travel guides, insurance schemes, international driving permits and club associations dominated their non-lobbying interests.[140] They were, overall, definitely non-technical in orientation. Also, in contrast to the good roads movement, the motor associations remained provincially based. Though the Canadian Automobile Association (CAA) was formed in 1915, it was merely a paper organization until 1957. Even today the CAA is small compared with the huge provincial counterparts that underpin it.

Several forces thus came together to shape road policy in the first 30 years of the 20th century. The primal force was the new technology of the car. Both as a form of practical transportation and as a cult of adventure and freedom, it created a totally unprecedented demand for good roads. Already in place as that demand grew, however, were a series of provincial organizations and then a national one dedicated to the improvement of roads, connected to the engineering and political elites of the day and seemingly well received by press and public. Then, parallel with the growth of the car came the car club, lobbying in the name of the driver and linked to the good roads associations, sometimes formally yet always informally.

These developments meant that government neglect of roads soon changed. Even before the car really took hold, the good roads movement and the demands of modern industrial society began to affect policy. In Quebec the provincial government moved through the Department of Agriculture in 1897 to give subsidies to municipalities for road improvement. In New Brunswick where intermunicipal roads were under direct provincial control, planning and funding improved. In Ontario a "Provincial Instructor in Road Making" was appointed in 1896, but the most important step came in 1901 when the *Highway Improvement Act* was passed. This provided a subsidy from the province to county road operations and marked the beginning of a long-term trend toward centralization in road construction. In Quebec, Acts in 1907, 1911 and 1912 regularized the principle of a provincial presence in both the funding and construction of roads.[141]

Centralization was necessary, for the car made the jurisdictional boundaries of the 19th century obsolete. When roads were relatively marginal feeder systems, it was enough for local units to take responsibility for them and to use the inefficient statute labour system to maintain them. Once the car arrived this had to change. For one thing, the longer distances now travelled on land meant that the burden on roads in an area might come from residents miles away. For another, the growing importance of the road system demanded some consistency of funding and construction. As early as World War I, for example, the City of Toronto realized that there was little point in improving its own roads if, once the traveller hit the city limits, travel ground to a halt. It therefore convinced the Ontario government to create the York Highways Commission to develop and maintain roads for 15 miles (24 km) around the city.[142]

The inappropriateness of local government being responsible for road policy after the advent of the car was recognized across the country. The next decades saw a trend toward centralization of road responsibilities. By World

War I most provinces had a distinct roads department or a division within departments of public works. The previously purely local system was complicated by a series of statutes and policies that provided subsidies to local units of government and saw the provinces directly involved in road construction. There was even federal involvement. In 1911 Robert Borden's Conservatives came to power. Borden pledged to take a more active role in facing modern problems than had his laissez-faire predecessor, Wilfrid Laurier. One of the first steps the Government took was to introduce a bill to provide federal funds to assist in the development of a national trans-Canada highway. The bill was defeated by a hostile Senate, but at the end of World War I the Government reintroduced it in slightly different form and passed it as the *Canada Highways Act.*[143] The involvement of the federal government, along with the growing role of the provinces, indicates just how far roads had come from being a purely local matter.

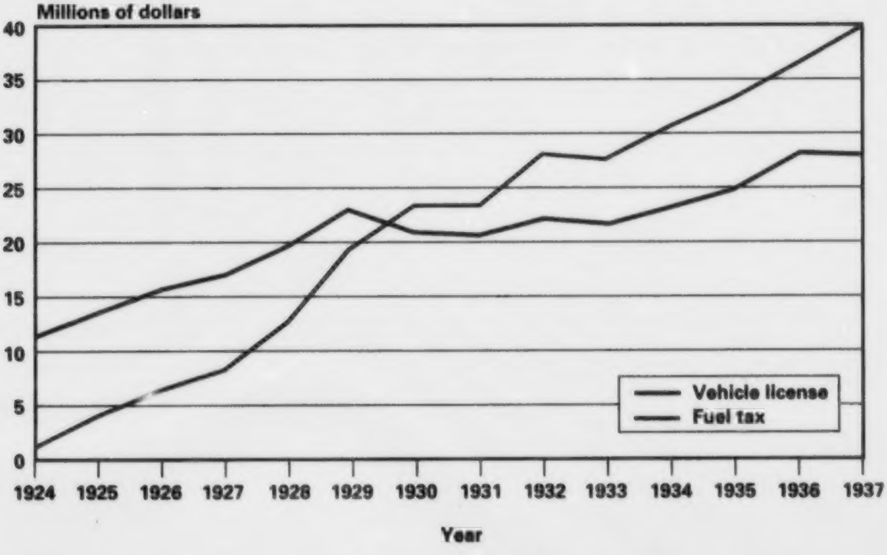
The emerging programs of road subsidy and construction at the provincial level were extremely expensive. Fortunately, the car, which was what created the burden, also provided the solution. Taking their precedent from the United States, the provinces began to impose taxes on cars to cover the costs involved in supporting them. Motor vehicle licensing provided an early source of revenue. Ontario began the practice in 1903, registering all of 220 vehicles that year.[144] Before World War I the registration or licence fee was also adopted by other provinces.

By far the most lucrative source of revenue, however, was inspired by a number of Western states shortly after the war. Beginning in 1919 Oregon, New Mexico and Colorado taxed fuel to raise money specifically for road construction. By 1925 the tax had proven so lucrative that some 44 states had adopted it.[145] Not surprisingly, the provinces were quick to notice the tax. They were facing unprecedented costs as the demands for roads grew. The *Canada Highways Act* only made the pressure greater: it had provisions for Government funding on a cost-sharing basis. If the provinces were going to take full advantage of this federal largesse, they were also going to have to pour large amounts of money into the road system. The fuel tax had the dual attraction of being lucrative and focussed on the very group that would most benefit from the new roads — the car user. In 1922, Alberta was the first province to implement a fuel tax. By the late 1920s every province had one.[146]

Initially the fuel taxes were modest and seen as a supplement to licence fees. It did not take governments long to discover that a hidden user-tax like this was more lucrative and elastic than increases in licence or similar fees. As a hidden tax and as one that varied depending on the use of the vehicle, it also seems to have been more accepted. There was some outcry in Ontario when the first fuel tax was increased in 1925, but generally the motoring public seems to have been relatively willing to accept the burden.[147] By the end of the 1920s a series of tax increases and the growing number of cars on the road meant that fuel taxes surpassed licence fees (see Figure 8). Within a few years fuel taxes accounted for approximately three quarters of all user-impost revenue.[148]

By the mid-1920s then, some important principles had been established for road policy. Most importantly, the new cost of roads had been met to a large degree by new taxes on road users. Over time the exact percentages of user-taxes devoted to highways would vary. In the 1920s, though figures

*Figure 8*
COMPARATIVE PROVINCIAL REVENUE FROM FUEL TAXES AND LICENSING FEES



Source: Statistics Canada (formerly Dominion Bureau of Statistics), *Canada Year Book*, 1925–1945.

are imprecise, it appears that road costs outstripped taxes. In contrast, during the Great Depression the cash-starved provincial governments spent less on roads than they took in. Then, after World War II, the percentages dropped again as massive road-building efforts were undertaken. In general, however, a rough correlation was maintained over the long term between user-tax revenue and expenditures. Occasionally this tie was required by legislation, but even where it was not the correlation existed as a matter of policy. Various commissions and investigations during the interwar years restated the principle that user-taxes on motorists should provide the basic tax support for the highway system.[149]

Two other precedents were set in the 1920s. First, the roads were to be public property. This may seem obvious, but remember that railroads were not public property (except when bankruptcy left no choice) and there had been considerable use of toll roads in the 19th century. By the 1920s, however, toll roads had fallen out of favour and were gradually assumed by the appropriate government. In Ontario, for example, the last toll road was made free in 1926. It would be another generation before toll roads reappeared.

Second, though roads were clearly a provincial matter, the federal government had recognized the overwhelming importance of the system and become involved. The 1919 Act, originally intended to expire in 1924, was in fact extended to 1928. The Act set aside $20 million of federal government money for cost sharing with the provinces. Each province would have access to $80,000 automatically. The rest was to be divided up in proportion to population. To qualify for the money the provinces had to be meet standards of construction established by the federal government. These were not high by modern standards but do indicate the roadway system was being designed for cars rather than foot or horse traffic. The federal government also had a say over which roads were eligible, though any main road seems to have been accepted. In this age of criticism of anti-patronage sentiment, all contracts had to be let by tender. When these conditions were met the cost-sharing system would come into effect: the federal government would pay 40 percent; the provincial government, 60 percent.[150] The federal assistance does seem to have been important in the great construction effort of the 1920s. The provinces were provided with welcome financial assistance at a time when there was tremendous demand for new roads. The federal involvement also set a precedent. Thereafter provinces continually sought greater federal involvement in the highway system. The federal government's involvement, however, has been intermittent: the Government oscillates between a desire to create a truly national highway system and a reluctance to get involved in a very expensive area outside its own jurisdiction.

The basis of the modern road system was established in the 1920s. In 1918 most of the system was still primitive. The only significant stretch of paved highway outside the cities was the concrete highway between Toronto and Hamilton. Only in parts of southern Ontario and in the area surrounding Montreal could one talk of a road system suitable for cars. Even then the roads were seasonal, closing down whenever the snow got too deep. In Nova Scotia, where the roads were better than in many provinces, the system was still sufficiently fragile that there was a provincial law on the books prohibiting motor traffic during the spring thaw.[151] The side of the road the motorist should drive on varied from province to province, and British Columbia had only just asserted uniformity on that *within* the province.[152]

The 1920s revolutionized Canadian highways in several ways. First, the technical obstacles to the development of a modern highway system were overcome. Roads designed for the horse and wagon were not suitable for the car. The speed and design of the car created new demands for gentle curves, limited grades and smooth surfaces. As well the wear and tear of cars were such that even a well-designed carriage road was unsuitable for car traffic. As the President of the Ontario Good Roads Association put it in 1914, "the automobile itself is quite a harmless instrument — a broad soft tire, but the rapidity at which it is driven upon our roads makes it a regular road smasher."[153] In the first 20 years of the century, failure to understand the implications of this fact led to numerous errors of planning. "Waterbound macadam," for example, reacted very differently under horses and cars. The slow, steel-rimmed wagon wheels compacted the macadam surface. The fast, rubber-tired car carved deep ruts into it.[154] In all areas, from drainage to gravel coverage to safe curvature, the car road had requirements considerably different from those of the older wagon road.

Second, until well into the 1920s only Ontario really had the demand or resources to create a full-fledged system of highway construction and maintenance. Other operations appear to have been relatively haphazard. In Alberta, for example, only one quarter of the maintenance appropriation was spent in 1922. Partly as a result of this, the legislature slashed the budget for 1923, leaving Public Works without the funds to do any but "the most urgent work."[155] That same year the entire maintenance cost for the main Edmonton–Calgary highway was only $6,961. The same general records of small expenditures, ad hoc arrangements and lack of long-term policy appear as well in the records of other provinces, or at least such other provinces as bothered to print annual reports on highway activities at all.

This changed dramatically through the decade. A 1923 report by the Ontario Minister of Highways said, "A much greater expenditure is to-day necessary and justifiable, as compared with the days when roads carried horse-drawn traffic alone."[156] Certainly roads received a great deal more attention than they ever had before. With aid from the Dominion government, provincial highway budgets multiplied many times through the decade and became one of the major expenditures. Highway departments expanded and became much more involved in long-term development strategies rather than merely keeping existing roads passable. In British Columbia, for example, work began on the tremendously expensive trans-provincial highway, which, when finished would create "a serviceable highway from the Coast to the Crowsnest Pass."[157] In Alberta the *Canada Highway Act* encouraged the province to create a high-quality north-south highway. By the end of the decade maintenance expenditures on it were 25 times higher than they had been in 1923.[158] In Ontario the emphasis was on the development of the King's Highway system, including a considerable amount of hard surfacing. New Brunswick was starting from somewhat farther behind than Ontario, but it too put considerable funds into developing a main trunk system and improving rural roads.

The final change came in the response to weather. Until the 1920s roads were at the mercy of nature. Snow-removal equipment was primitive and the expenditure small. Ontario, for example, spent less than $5,000 a year on snow removal through the early 1920s. Quebec spent less. The result was that roads, as always in the past, were in effect seasonal operations outside of the cities. Improved surfaces and drainage lengthened the season, but a snowstorm still shut the system down. Cars disappeared and sleighs took over. The roads "returned" to the 19th century.

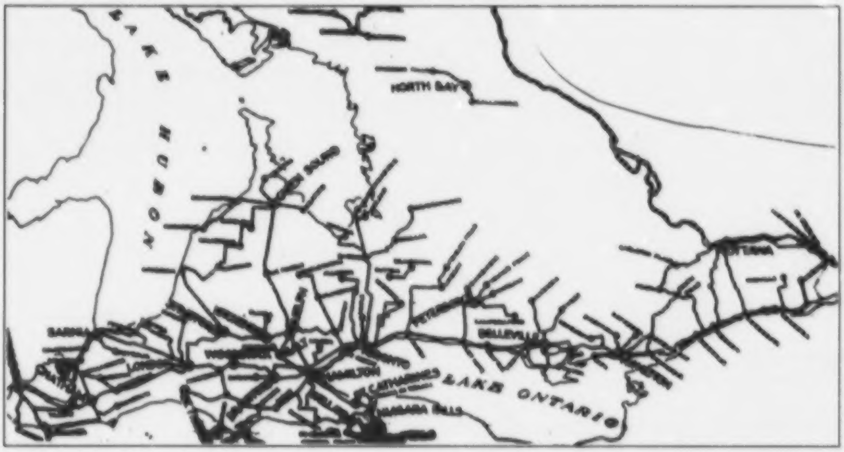
As cars, buses and commercial vehicles became a standard part of the national culture and economy, however, such seasonality inflicted an ever greater social and economic cost. By the later 1920s all provinces were making more of efforts to create an all-weather road system. Ontario bragged that it maintained some 1,200 miles (1,900 km) of roads all winter (though snow could and did shut them for days at a time). Other provinces had neither the hard-surface mileage of Ontario nor the same money to spend on snow-removal equipment. Nevertheless, all provinces sought to keep at least the main highways open through the winter.[159] It would be another generation, however, before year-round car travel became the norm outside the cities of Canada.

What did this all mean by the end of the decade? What was the state of the Canadian highway system at the onset of the Great Depression (and it wouldn't change much for the next few years)? How, if at all, were railways affected by the rising popularity of the car? The most striking thing is the change that had taken place in a decade. There were still a good many bad roads, but the Canadian highway system had been redesigned and rebuilt for the car. Tracks had been turned into regularly passable roadways. Links between cities had been upgraded so that intercity automobile travel was routine, at least over short and medium distances. Nor was the car an exotic sight any more. Summer traffic on the Toronto–Hamilton road was upwards of 5,000 cars a day by 1926, and by the end of the decade the main road out of Vancouver was carrying more than 9,000 cars a day.[160]

In contrast to the spread of the car, the use of the horse was declining. At the end of World War I roads everywhere had to carry both horse-drawn and motorized traffic. By the end of the decade the horse and carriage had become an increasingly rare sight along major highways, especially in the more urbanized east. Not only were there fewer of them, but as car numbers and rates of speed increased it took a degree of hardiness to bring a horse onto the main highways. Horses and carriages were now more or less confined to rural areas, and even there they tended to stay off the main roads.

Related to the motorization of the roadway was the development of commercial bus service. Through the 1920s bus service improved. In 1926 regular coach service began between Calgary and Banff. By the end of the decade the main cities of Alberta were served by scheduled bus lines.[161] In Ontario, as Figure 9 indicates, an extensive system of bus routes had been developed, providing the first significant competitor to railways for the public passenger dollar. Railways, indeed, had now cast aside their earlier friendly attitude toward the car and were increasingly demanding that buses "pay their fair share." Complex studies and adjustments of licence fees, gasoline taxes and related issues would become a major subject of discussion through the depression years as all modes of commercial carrier found their revenues in decline.[162]

Figure 9
1927 BUS ROUTES IN ONTARIO



**Source: Ontario, *Annual Report of the Department of Public Highways*, 1927, p. 188.**

For all the improvements that had been made in the road system, two facts that emphasize the limitations that still existed stand out. First, driving in the 1920s meant driving for the most part on gravel or unpaved roads. In Alberta, for example, the bulk of federal funds under the *Canada Highway Act* had gone to improve the main north-south route, Highway 2. By the end of the decade the province could boast of a "modern" gravel highway extending from Lethbridge to Edmonton. North of that it was still a rudimentary dirt road. A small section (70 miles [113 km]) was even paved in the early 1930s, but the Great Depression meant that most of it was gravel until after World War II.[163] The same conditions prevailed in Manitoba and Saskatchewan and through much of the Maritimes.

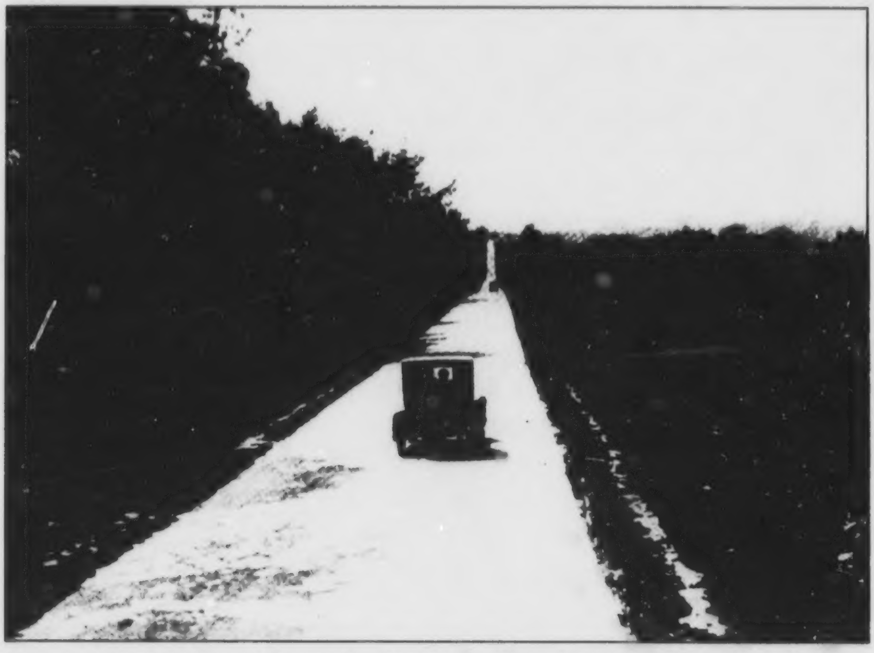
There were exceptions to this rule in the vicinity of the major urban centres. British Columbia's roads on the lower mainland and southern Vancouver Island had hard surface by the later 1920s. So too did Quebec's highways in the vicinity of Montreal. Ontario had by far the most extensive system, with some 1,800 miles (2,890 km) hard surfaced in one fashion or another as early as the mid-twenties.[164] The main highways westward and eastward from Toronto were paved, and it was possible to go all the way to Montreal or Windsor on a paved highway. Even in Ontario, though, pavement was restricted to the major arteries. If one deviated from what is now known as the corridor, gravel became the rule. Only about 5 percent of Ontario highways were hard surfaced by the end of the decade. Moreover, even the paved highways were relatively narrow, with 18-foot (5 m) surfaces and gravel shoulders (see Figure 10).

At the end of the 1920s Canada's highway system was also limited by its regional nature. The *Canada Highway Act* had not tied grants to any sort of trans-provincial linkages, and provincial governments followed traffic demand rather than encouraging interprovincial links. At the end of the decade it was still impossible to drive across Canada. British Columbia was not connected to Alberta despite the efforts to create a trans-provincial highway. Ontario was not connected to itself: there was no road around the north of Lake Superior. Given the accessible American road system, the problem was probably more symbolic than real. More difficult and more costly was simply the patchiness of the Canadian road system. Except perhaps in the Windsor–Montreal corridor, long-distance travel by car was still difficult. Speed limits were still relatively low (they varied, but 30–35 mph (48–56 km/h) outside cities was typical). "Good roads" were still confined to the major transportation corridors and oriented on provincial rather than national needs. Whereas the railroad system had strong nationalist associations, the road system was, after the first 30 years of the car, regional in orientation and uneven in standards.

The car was sufficiently important by the 1920s, though, that the railways began to complain about "unfair competition." "Motor vehicle competition by private automobile, bus and motor truck," complained the CNR in 1931, "has made serious inroads into the railway's traffic. . . . The use of the motor vehicle beyond its proper economic sphere can have no other effect than to increase the total cost of transportation to the citizens of Canada."[165] That "proper sphere," apparently, did not include competition with railways. Concern focussed on two areas in the interwar years. The first, not relevant to this paper, was short-haul freight: commercial trucking firms entered into competition with railways quite early and quite effectively. The second is relevant, however: the railways saw the car and bus as just as much a threat to passengers as to freight.

*Figure 10*

**No. 2 Provincial Highway, 5 Miles East of Bowmanville**



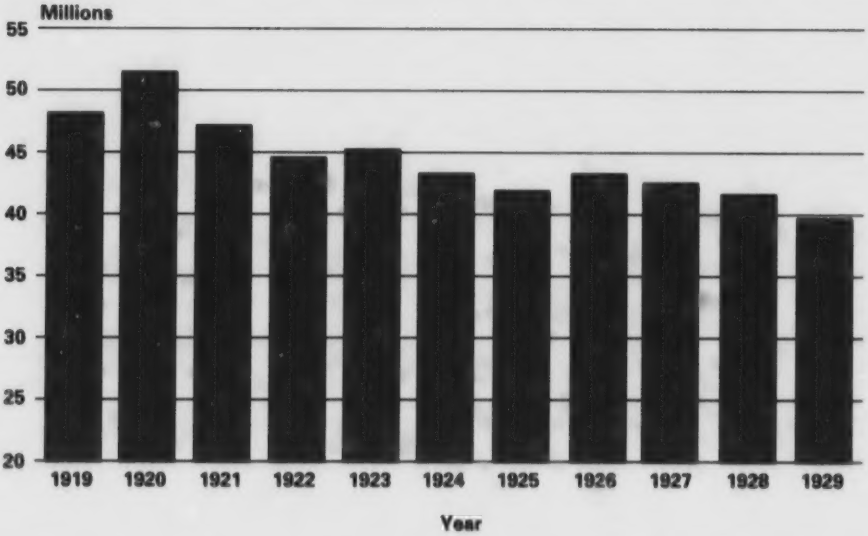
**Source: Ontario Archives, Negative No. A0913 (reproduced in Ontario, *Annual Report of the Department of Public Highways*, 1926, Frontispiece.)**

The main concern was the attractiveness of the car to the individual or family going a relatively short distance. A trip from, say, Hamilton to Toronto or Brandon to Winnipeg by horse and wagon was not competitive with the speed, comfort and even cost of the train. The same could not be said when it came to a comparison between the train and the car. Even more threatened was the very short haul. Why travel according to someone else's schedule over a distance of 10 or 15 miles when you could simply start the car and drive off?

An historian of the Canadian national system confirmed the concerns of railways, noting that the "motor car had taken a heavy toll of railway passenger traffic."[166] The statistical material available also shows some support for the railways' fears. Though the 1920s were generally good ones for the railways, several indicators imply either a static or somewhat declining passenger market. As Figure 11 indicates, for example, there was a slow decline in the number of railway passengers through the decade despite improving economic conditions after 1921 and a growing population. Figure 12 also gives at least indirect evidence that there was a correlation between the rise in cars and the erosion of passenger numbers on the railways.

The competition from cars and buses at any time between the wars should not be overstated, however. For one thing there was simply not enough of them. As mentioned, even by 1929 there was only one car for every nine Canadians. For the great majority of Canadians, public transportation was still the standard means of travel. Even for those who had cars, the technology and infrastructure of motoring were not yet adequate for regular travel over anything but the shortest distances. Cars had come a long way in the decade, but they were still designed for relatively low speeds and short distances. Suspension systems were rudimentary. Most cars were not heated. For that reason as well as the primitive nature of snow clearance, much motoring was a seasonal phenomenon.

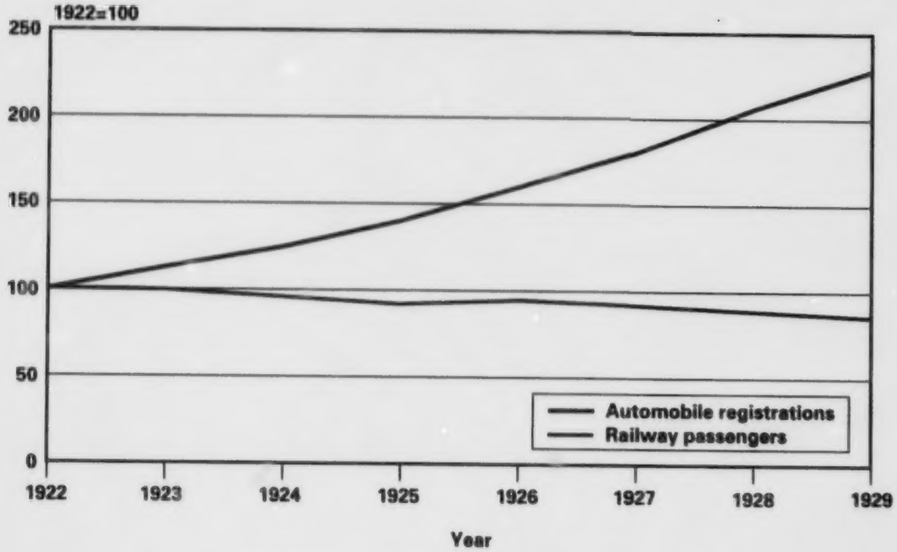
*Figure 11*
*NUMBER OF RAILWAY PASSENGERS CARRIED, 1918–1929*



**Source: Statistics Canada (formerly Dominion Bureau of Statistics), *Canada Year Book*, 1930, p. 626.**

*Figure 12*

***RAILWAY PASSENGERS AND AUTOMOBILE REGISTRATIONS, 1922–1929***



**Source: Statistics Canada (formerly Dominion Bureau of Statistics), *Canada Year Book*, 1930.**

Between the wars the most serious challenge to the railway came in a specific area, short-haul commuter traffic. It was the electric and street railway, designed for brief trips and constructed in and around those urban areas where roadways were usually best, that faced the brunt of the competition. Electric railway mileage peaked in the late 1920s, and thereafter abandonment rather than construction was the trend. By the 1950s many cities had totally abandoned their electric rail systems. Others had only a vestige of this once crucial urban and commuter link.[167] Across greater distances, however, the car was but a minor threat to the dominance of the railways in passenger travel. The commercial airplane was such an insignificant factor before World War II that all discussion of it is best deferred until after 1945.

## THE GREAT DEPRESSION

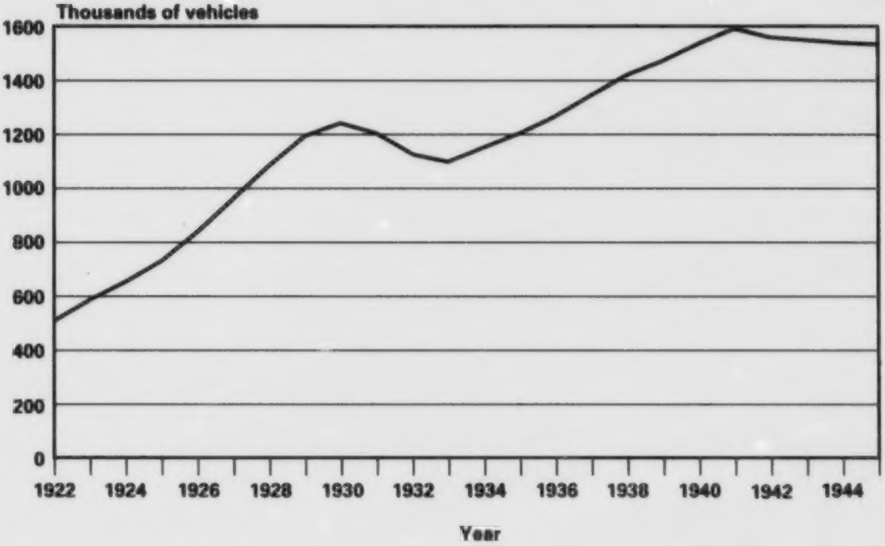
In 1929 the economy turned downward as world commodity prices collapsed. Canada, as a major exporter of such commodities, was quickly affected. The Prairies had a bad year in 1929, and by 1930 the economy was in trouble across the country. For the next three years the Canadian and world economies would continue to shrink until, at the bottom, world trade was at only one third of the level of 1929. Then, for the rest of the 1930s, there was only slow and intermittent improvement. Not until the World War II was the Canadian economy prosperous once again. In the intervening years all aspects of Canadian passenger transportation were affected.

The Great Depression rapidly brought the highway boom of the 1920s to a halt. This is hardly surprising. The depression shrank the financial resources available to governments. In 1930 provincial revenues had reached an all-time high of $188 million. By 1933, the low point of the depression, they had dropped to $152 million, or by almost 20 percent.[168] At the same time provinces were being pulled by bankrupt cities into more and more involvement in relief programs. As a result deficits rose and so too did the pressure to cut costs wherever possible. Road programs were a natural target. For one thing, government cutbacks are often carried out at the expense of the infrastructure. Capital projects can readily be delayed. So too can maintenance, which can be minimized with the recognition that a delay of a year or two will unlikely do much harm.

Another factor reinforced the tendency to delay capital construction. With the depression, automobile ownership ceased to increase at anything like the rate it had before. Indeed, for a period between 1931 and 1934 absolute automobile ownership decreased in Canada (see Figure 13). This would happen again, though at a lesser rate, between 1941 and 1945 as wartime restrictions curtailed production. Even when registrations did turn upward in the later 1930s the rate of growth was much slower than in the 1920s (see Figure 14).

At a time when governments were starved for revenue this decrease in the rate of growth of cars for some 15 years (and absolute drop in ownership for part of the time) provided a welcome respite. Capital expenditures could be slashed not just on the basis of fiscal necessity but because of decrease in demand. Maintenance was in theory less affected by the halt in the growth in the number of cars, but that too was cut back severely. Revenue decreases, said the 1932 *Alberta Annual Report of the Department of Public Works,* "made it imperative to curtail highway expenditure to such an extent that the utmost economy and watchfulness became necessary." The *Ontario Highways Report* for 1933 referred to a decrease in activity both in maintenance and construction because of "the depressed state of the financial economy."[169] It was the same everywhere as provinces finished off old projects and postponed or cancelled new ones.

*Figure 13*
**REGISTERED MOTOR VEHICLES**

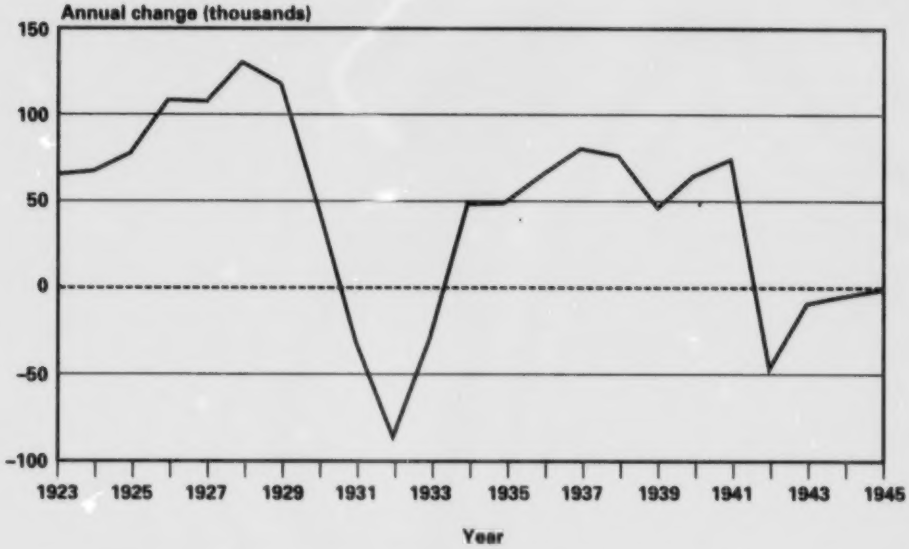


**Source: Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series T147-194.**

The overall decrease in provincial expenditure on roads was dramatic, declining by 60 percent between 1930 and 1933. Thereafter expenditures increased, but it was 1937 before highway expenditures recovered to previous levels. In the meantime user taxes on cars actually increased: cash-starved governments raised the vehicle registration fees and fuel taxes repeatedly through the decade. At the end of the 1920s user fees had recovered only about 50–60 percent of the total provincial highway expenditure in Canada. In five of the 10 years of the Great Depression user revenue matched or exceeded total provincial highway expenditure. User taxes were now subsidizing general revenue rather than vice versa. This pattern would become even more dramatic in World War II as road taxes outstripped expenditures during every year of the war, sometimes by as much as 50 percent.

Hard as the roads were hit, the railways were hit harder. The depression affected them almost immediately. Revenues dropped in 1929 and again in 1930 as wheat shipments declined from the Prairies. Then, as the depression hit home, people travelled less on business or pleasure, and passenger

*Figure 14*
**MOTOR VEHICLES REGISTERED**



**Source: Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series T147-194.**

traffic plummeted. The joint operating revenue of the two systems decreased from $469 million to a low point of $262 million, a decline of 45 percent. In response, both railway systems scrambled to avoid collapse. They reduced their operations, drastically slashing the number of trains, maintenance levels and the work force. By the low point, activities had been cut to the point that it was as if one of the railway systems had disappeared.

The two railways were affected differently. CPR was better able to weather the storm, though it had to suspend dividend payments for the first time since the completion of the transcontinental line and even had to turn to the government for some short-term debt guarantees.[170] Things were worse for CNR. The fixed debt CNR had inherited from the Grand Trunk and Northern railway systems meant that even in good years it was difficult for it to meet expenses and debt charges. To make matters worse, CNR was not really a coherent network of railways. It was a patchwork, put together from all those overextended, non-viable lines the government had assumed over the years. Finally, CNR had been as aggressive as CPR in adding to Prairie branch lines through the 1920s, which of course added to the debt as well.[171] At the beginning of the Great Depression CNR's debt was massive, equivalent to one quarter of the national debt.

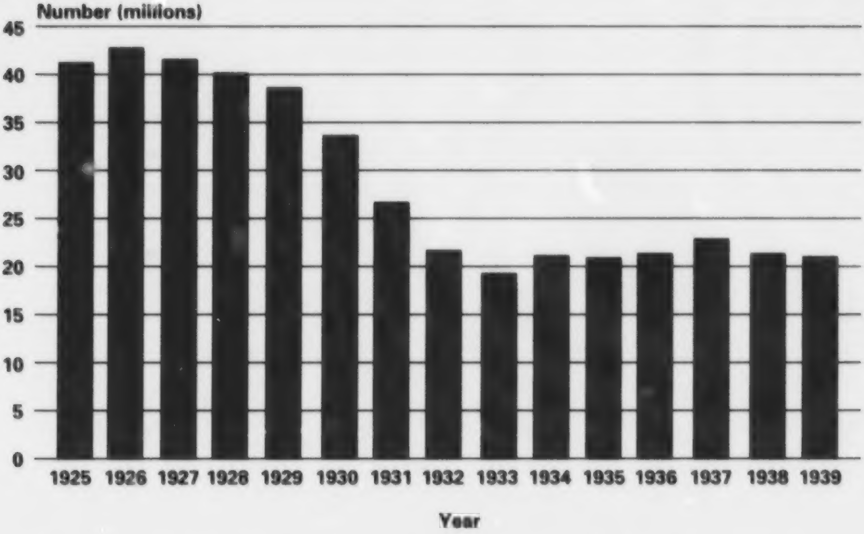
CNR's financial position made it especially vulnerable to the depression. In 1929 CNR had an operating revenue of nearly $260 million, against operating expenses of just under $215 million; the profit therefore was approximately $45 million, excluding payments on debt. By 1933 revenue had declined to less than $150 million; operating expenses, to $143 million. The ongoing operation was just a little more than half the size it had been before the Great Depression.[172] In the same period, the number of employees declined from more than 111,000 to 70,000.

Passenger systems played an important part in both the decline in revenue and the reduced services. During the 1920s, as we have already seen, passenger- related services like hotels had been major expenses for both systems. A 1931 royal commission used the benefit of hindsight to condemn the two railways for creating "a standard of passenger travel quite beyond the needs of the country" and for excessive expenditures on hotels.[173] Then, after all that expenditure, passenger travel collapsed. As Figure 15 indicates, the decline in ridership continued until 1933, by which time the railways were carrying half the passengers they had in 1928. Thereafter the decline halted, and there was even some improvement. Even after a decade, however, passenger traffic had improved only marginally from its low point and was far below the level of the 1920s.

Passenger revenue declined even more sharply than passenger numbers. As Table 2 shows, between 1929 and 1930 CNR experienced a 14 percent drop in passenger revenue, with another 29 percent drop in 1931. People simply could not afford to travel any more. Sir Henry Thornton, President of the company, had always been interested in passenger service. Nevertheless, the company was desperate and immediately moved to slash expenses. New car orders were delayed. Some of the more expensive luxury services (for example, parlour cars, sleeping cars) were cancelled on various runs, and services themselves were slashed. The number of passenger-miles decreased by 480,000 in 1930, more than 3 million in 1931 and close to 5 million in 1932. The CNR *Annual Report* commented that this was "equivalent to wiping out practically one-third of the passenger train service operated in 1929."[174]

*Figure 15*

*THE DEPRESSION AND THE DECLINE IN RAILWAY PASSENGERS*



**Source: Derived from Canadian National, *Annual Report*, for the years 1926–1939.**

*Table 2*

*CANADIAN NATIONAL RAILWAY PASSENGER REVENUE, 1929–1940*

| Year | Passenger revenue ($000) | Passenger revenue as % of operating revenue |
|---|---|---|
| 1929 | 32,013 | 12.32 |
| 1930 | 27,537 | 12.42 |
| 1931 | 19,657 | 11.09 |
| 1932 | 17,259 | 10.71 |
| 1933 | 15,032 | 10.12 |
| 1934 | 17,554 | 10.65 |
| 1935 | 17,863 | 10.31 |
| 1936 | 17,022 | 9.12 |
| 1937 | 18,945 | 9.55 |
| 1938 | 18,097 | 9.93 |
| 1939 | 17,817 | 8.74 |
| 1940 | 21,702 | 8.77 |

**Source: Derived from Canadian National, *Annual Report*, for the years 1930–1940.**

Some writers have looked back on the Great Depression as a fundamental turning point in the history of passenger transportation on railways. Until then, this argument goes, the railways had seen passenger transportation (and ancillary services) as an important part of their revenue and as a matter of prestige as well. Then, with the depression, the whole emphasis on passenger service shifted from growth to retrenchment and from prestige to liability. Rail passenger service never recovered thereafter.

There is some evidence for this. There is no doubt that the Great Depression brought a tremendous reduction in service. A good many marginal routes were cancelled; services on others were cut back. The public, which had become accustomed to ever-improving regularity and proximity of passenger services, now experienced the reverse. Even as the Great Depression lifted and some services were restored, rail transportation was not as it had been before. Many of the routes were not revived, and on more major runs there were fewer trains scheduled than before. Even well into the boom times of the World War II, for example, passenger-miles were well below what they had been in the 1920s. As we have seen, both railways trimmed operating expenses by reducing capital expenditures and deferring indefinitely much-needed maintenance on tracks and equipment. Trains became a little more infrequent, services a little more difficult to get at and the level of comfort a little lower. As we will see, the war provided the railway with certain advantages, and a sharp increase in ridership resulted. The conditions during the war were abnormal, however, and once it ended the railways found themselves facing more competition than ever. The decade of the Great Depression and the reduction in equipment and service did much to undermine the railways' ability to meet that competition.

Another reason to think of the 1930s as a turning point comes when one looks at the relative importance of passenger traffic on the system. For it was in the 1930s that passenger traffic on both major lines began to slip in importance. As Table 2 shows, CNR's passenger traffic accounted for 12.32% of revenue in 1929 and only 8.74% a decade later. The same relative decline occurred on the CPR: 6.7% in 1929 and only 4.8% a decade later.[175] When these figures are put together with the lesser declines in the relative importance of passenger revenue of the 1920s, the cumulative trend is quite significant. Passenger services were becoming a peripheral part of the railway operations.

Finally, the 1930s were a turning point because of the changes in the relationship between the railways and the Government. Not surprisingly, given the importance of the railways to the national economy and the tremendous burden that CNR placed upon the Dominion treasury,[176] there was a great deal of controversy surrounding the beleaguered railways in this decade. There were parliamentary hearings, the already-mentioned royal commission and some significant alterations in Government regulatory practices. Sir Henry Thornton, the pro-passenger head of CNR, was removed and CNR was placed first under a board of commissioners and then returned to its traditional form of governance. In 1936 the Department of Transport was formed, replacing the old Department of Railways and Canals.

Perhaps the most important change in passenger transportation arose from the growing concern of the Government. It asserted with increasing force its right to intervene in railway business decisions with an eye to the public good. Of course, as we saw earlier, this precedent was well established under the common-carrier rule. Since 1903 the Board of Railway Commissioners had sought to protect passengers' basic health and safety as well as regulate the passenger fare system. Still, at the beginning of the 1930s, railways made the decisions about what trains to run and whether they should be run at all. The Minister of Railways and Canals summed it up in 1933 when queried about cutbacks in passenger service in northern Ontario. "Such matters as running trains are not discussed in any shape or form with the government. That is entirely a question of railway management."[177]

Such attitudes were feasible as long as the overall railway passenger system was healthy and, for the most part, expanding. The Great Depression destroyed any such assumption. Passenger service was decidedly no longer a growth industry. As with railway service generally, the tendency was now toward a reduction rather than improvement in service. The government increasingly feared, however, that in the panic of railways to reduce expenses the welfare of the public would be ignored. In such circumstances the Government felt bound to step in. Thus in 1933 it passed a new statute requiring railways to get the approval of the Board of Railway Commissioners before abandoning lines.[178] This stopped short of Government supervision of specific passenger services, but it was a significant change in the previous assumption that such matters were best left to the companies involved. Over the next few years both CNR and CPR regularly applied for permission to abandon lines and, on average, won the right to do so in about half the cases. Thus the Great Depression set precedents for dealing with a new reality — declining service. The Government extended the precedent of the common carrier by asserting its right to control branch-line abandonment. The railways, for their part, found themselves in the uncomfortable position of being forced to operate unprofitable lines. Though these precedents applied to abandonment, the practices could and would be extended to the provision of specific services within a few years.

The railways did provide a cheap service for a population that could afford little more. CNR boasted in 1934 that standard fares amounted to only 2.25 cents a mile (1.4 cents a kilometre).[179] Along the way, however, the sharp drop in revenues forced CNR to reduce the choice of trains and the level of service. By the end of the 1930s the train was not as accessible or convenient a mode of travel anymore. Also, despite some improvements such as a limited introduction of air-conditioned cars after 1935, passenger equipment was allowed to run down in the 1930s. The war only exacerbated the problem so that by 1945 equipment was increasingly unreliable and shabby. Massive overhauls and purchases would be needed to bring it back to the standards of pre-depression days. Finally, all of this was happening as the relative importance of passenger service was declining. Passenger service, once the most prestigious part of a railway's business, was not yet seen as an undesired burden, but it was increasingly an operation of peripheral importance.

## WORLD WAR II

World War II saved the railways from imminent collapse. The Great Depression came to a rapid end as the nation produced the goods for a modern industrial war machine. On the Prairies wheat harvests recovered along with world wheat prices, and grain shipments on the railways recovered in parallel, first to pre-depression levels and then to new records. The operating revenues of both railways shot up even more dramatically than they had fallen at the beginning of the 1930s, increasing by 67 percent between 1939 and 1941.

Initially, in a trend that continued from the late 1930s, most of this improvement was in freight services. In the case of CNR, for example, 1939 saw freight revenues increase by 14.6 percent, compared with a 1.5 percent decrease for passenger revenue.[180] It was not long, however, before passenger travel also boomed. The number of passengers carried by the railways tripled between 1939 and 1944 (the peak year). Revenue expanded accordingly, reaching all-time highs in both current and constant dollars.[181] By the end of the war some 60 million passengers rode the trains — five trips for every Canadian citizen.

Much of the boom in passenger travel during World War II was a short-term anomaly, for the recovery of passenger service, spectacular though it was, did not represent a return to a more competitive and hence more profitable position for the long term. With the one exception of 1944, passenger traffic did not recover to a point where it could match the ridership of the 1920s. Railways did as well as they did in the war years for very specific reasons. Car transportation was severely restricted by two factors. Canadians had not replaced their cars very quickly during the depression years. For a time registrations had actually decreased, and even toward the end of the 1930s people tended to hang onto the existing vehicle, make one more round of repairs and hope the thing would run another winter rather than go into debt or squander precious savings to buy a new one. By the beginning of World War II, therefore, Canadian cars were rather old overall. Undoubtedly there would have been massive replacement of them in the prosperity of the war years except that production of new cars effectively ceased by 1940 or 1941. No doubt there was tremendous demand for cars, but they were simply not available. Car registrations actually declined during the World War II, as did the number of miles driven.[182]

There were additional restrictions. Gasoline rationing began in 1942, thus limiting the amount of driving owners of cars could do. Even commercial activities were restricted. Intercity bus trips were restricted to no more than 50 miles (80 km).[183] Taxi travel between cities was also effectively prohibited. Airline travel was still in its infancy, and during the war regular flights were practically impossible to get. Thus, for the duration of the war, there was no real commercial competition for the railways over longer distances: this was a time when wartime business, troops coming home on leave, and relatives visiting troops on station created more than enough traffic to make up for the absence of immigrants or tourists. The formal railway rates for passenger services were not increased during the war because the rates, as with much else in Canada, were frozen under Wartime Prices and Trade legislation. Nevertheless, railways were effectively able to increase revenue by dropping the deeply discounted excursion fares that had been used to lure customers during the Great Depression.

The wartime boom in passenger travel, therefore, did not mark a return to the golden pre-depression years. Yet it was important not just because it rescued railway passenger services from insolvency but because it introduced a new generation to train travel. The train took the soldiers off to war, and the train brought them back home. The train took the young bride off to Halifax or Esquimalt or elsewhere to meet her husband on shore leave from the Navy. The train moved the war materials and responded efficiently to the crisis of these years. Once again, the train's role as a part of the sense of national identity was reinforced.

## 5. THE COMPETITIVE ERA AND THE RISE OF THE PASSENGER POLICY ISSUE: 1945–1967

> . . . we find that there is little social justification and less economic, for the permanent provision of railway passenger services as we know them today. The public, by and large, has already indicated its preference for other modes of travel. . . . (MacPherson Commission, 1961)[184]

Until sometime around World War II, passenger transportation in Canada was dominated by the railway companies. The car had made inroads, but these had been limited by the Great Depression and by wartime restrictions on production. In contrast, the post-war era brought the end of dominance by railways as the car achieved hegemony over shorter distances and the airplane over longer ones. As this happened the railway passenger travel networks became extremely costly to maintain. From the later forties onward the companies sought to reduce or eliminate specific services and increasingly looked for internal forms of cross subsidization and then direct Government support. Politicians and the public, who until then had been focussed on freight rates, increasingly turned their attention to the passenger issue.

Many services have disappeared with minimal fuss when outcompeted by newer forms. Lake- and ocean-going passenger ships disappeared, as did most streetcars. Aficionados lamented their passing, and a few editorials complained about the disadvantages of the loss of service. Generally, however, neither Government nor the public expected such transportation systems to remain beyond their competitive life. Passenger railways were and are a different matter, however. The railway was so vital in the recent past of the nation and its mythology so entwined with national history that abandonment could not be considered just another step in the evolution of technology. Further, the well-entrenched doctrine of the common carrier meant that there were numerous precedents for treating the railways as a public commodity. There were also a rising number of precedents for subsidization of railway services in the name of some national or regional goal. Currents of nationalism from the mid-1950s onward complicated the issue. The abandonment of the railway seemed tantamount to weakening Canada. Regional balances came into question as outlying communities and smaller urban centres complained that the destruction of rail service was a betrayal of their place in the nation. All of these debates occurred against ever-mounting passenger rail losses and a more competitive transportation network.

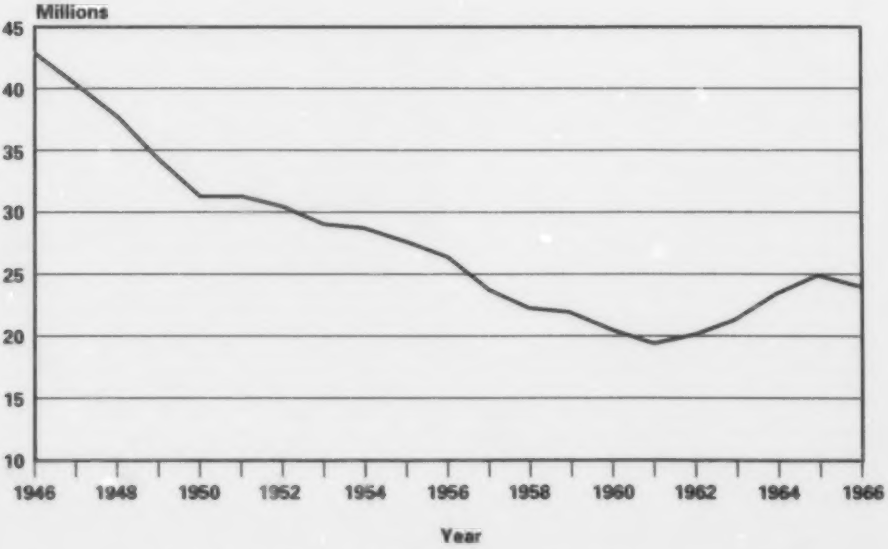
In rough terms the post-war era can be divided into two parts. The first part, from 1945 to the mid 1960s, was one in which passenger transportation and passenger transportation policy was in a state of uncertainty. The government, faced with political pressure on issues like freight rates and line abandonments, did not really look at passenger transportation as a distinct problem. In the meantime travel by car and air was expanding rapidly, changing the economics of passenger rail more quickly than the railways could adjust their policies or practices. The railways were still interested in providing passenger service, but both they and Government seemingly underestimated the changes that would be needed to cope with the new conditions of the post-war situation. The report of the 1961 *Royal Commission on Transportation* (MacPherson Commission) and the passage of the *National Transportation Act* (1967) mark a rather drawn-out transition to the second post-war era. By this time the Government recognized that the previously powerful passenger rail system was less able to compete with other modes. The Government sought to deal with the situation by allowing a combination of abandonment and subsidy, depending on social and economic circumstances. Thereafter passenger rail became a subsidized system in which various policy steps attempted to balance public demands for ongoing rail transport against governmental desires to reduce subsidies and rationalize the system.

Two things link these distinct periods. The Government increased its activity and investigation in the area of transportation in the post-war period. There were two royal commissions on railway problems in just over a decade. In between there was a third (the Gordon Commission),[185] which dealt with the issue as a part of Canada's economy. Freight and passenger rates, which had been more or less stable for a generation, were increased several times, then reduced, and then subsidized as Government sought a solution for the changing situation. Subsidies multiplied in size and diversity.[186] Through all the changes both the Government and the public wrestled with two difficulties. The first problem, as a post-war transportation economist put it, was whether "transportation services to be regarded as business institutions like department stores, factories, or farms, or are they to be looked upon as almost eleemosynary agencies wherein the cost-revenue relationship is subordinate to the welfare of the public?"[187] The second problem was to recognize that a system of regulation that had grown up because of the power and effective monopoly of the railways now had to be readjusted because of their weakness in the face of cars, buses, and airplanes.

## THE RISE OF COMPETITION IN THE POST-WAR ERA

The decline of railway control of land travel after World War II is readily demonstrated. Every measure indicates the same story. After the records set during the war, passenger travel by railway dropped sharply. As Figures 16 and 17 show, the railways quickly found that the ridership levels

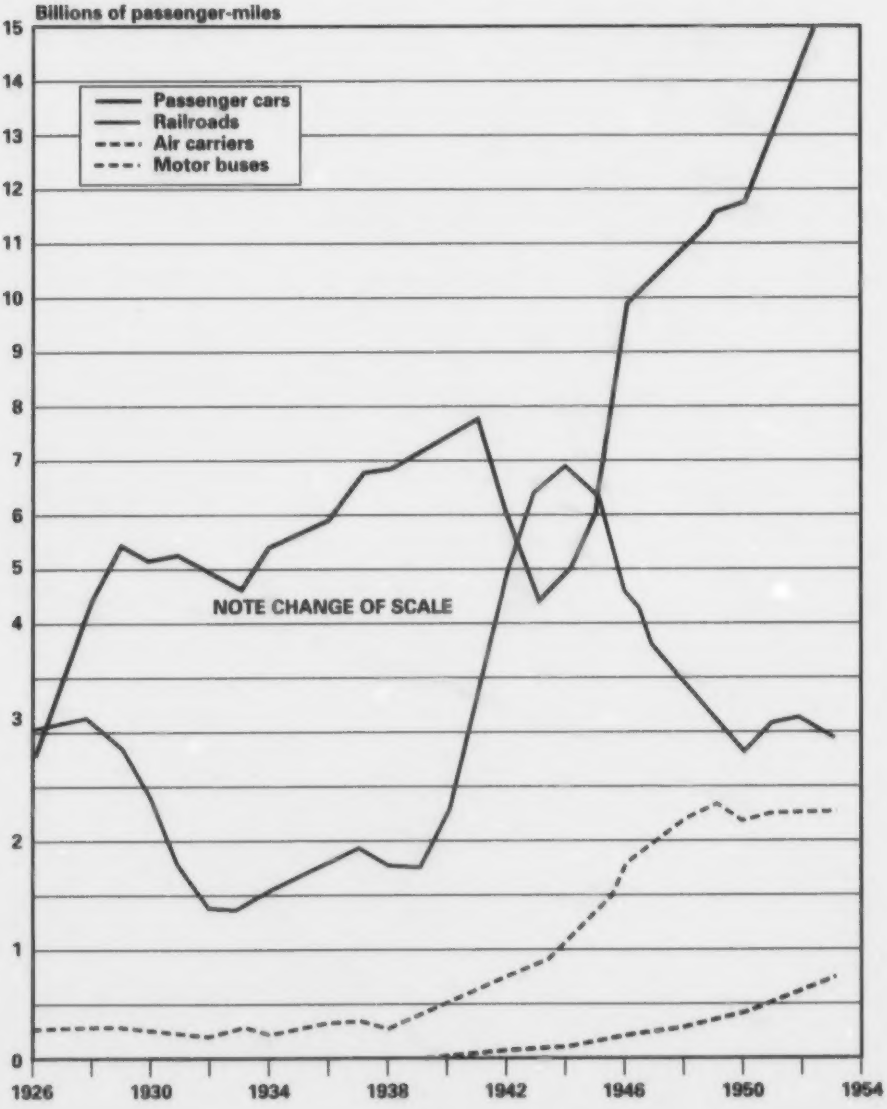
*Figure 16*
*Number of Railway Passengers*



**Source: Statistics Canada (formerly Dominion Bureau of Statistics), *Canada Year Book*.**

Figure 17

ANNUAL VEHICLE-MILES OF TRAVEL IN CANADA, 1926–1953



Source: Gordon Donald Campbell, "An Analysis of Highway Finance and Road User Imposts in Canada," PhD thesis, Purdue University, 1956, p. 62.

of the war years were artificially high. Conversely, car miles increased dramatically once wartime restrictions disappeared. A steady downward trend in both the absolute and relative position of railways began that continued until, by the end of the 1950s, ridership levels were returning to those of the depression era.

Revenue followed numbers. Railways could not increase fares to make up for declining ridership because that would only accelerate the desertion to other modes of transportation. Instead, to keep customers they had to cut fares. Excursion packages, discounts and group rates were used to woo passengers. Some of these helped, but the general trend was irreversible. This is especially striking because revenue was falling, even though Canada's population was rapidly growing as a result of the famous baby boom and high post-war immigration. As Table 3 indicates, the population was using railways much less frequently on a per capita basis. Travelling by train was a much less common experience by the 1960s than it had been even 15 years earlier. The long-term trend was even more dramatic. Average Canadians of the early 1960s took only one fifth as many trips as their grandparents had in the 1920s.

*Table 3*

***ANNUAL RAIL PASSENGER REVENUES AND RIDERSHIP, 1946–1966***

| Year | Passenger revenue (millions of 1971 dollars) | Passenger trips per Canadian |
|---|---|---|
| 1946 | 222.22 | 3.53 |
| 1947 | 178.46 | 3.26 |
| 1948 | 148.31 | 2.99 |
| 1949 | 146.72 | 2.60 |
| 1950 | 131.66 | 2.27 |
| 1951 | 134.85 | 2.21 |
| 1952 | 134.17 | 2.09 |
| 1953 | 128.36 | 1.93 |
| 1954 | 121.81 | 1.86 |
| 1955 | 122.96 | 1.73 |
| 1956 | 124.53 | 1.62 |
| 1957 | 122.91 | 1.38 |
| 1958 | 106.47 | 1.25 |
| 1959 | 100.27 | 1.20 |
| 1960 | 93.14 | 1.09 |
| 1961 | 81.60 | 1.03 |
| 1962 | 79.84 | 1.04 |
| 1963 | 77.07 | 1.09 |
| 1964 | 81.04 | 1.19 |
| 1965 | 81.61 | 1.25 |
| 1966 | 75.21 | 1.16 |

**Source: Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series T44, T62.**

In the 1930s the railways had suffered along with the rest of the economy. This time revenues were declining despite national prosperity. With the exception of only a couple of short-term recessions, Canada underwent steady economic expansion from the war's end until the later 1960s. In the case of railway travel, however, the economic boom only exacerbated the difficulties of passenger transportation, for it enabled the more rapid introduction of alternative forms of technology, the car and the airplane.

## CARS AND ROADS IN THE POST-WAR ERA

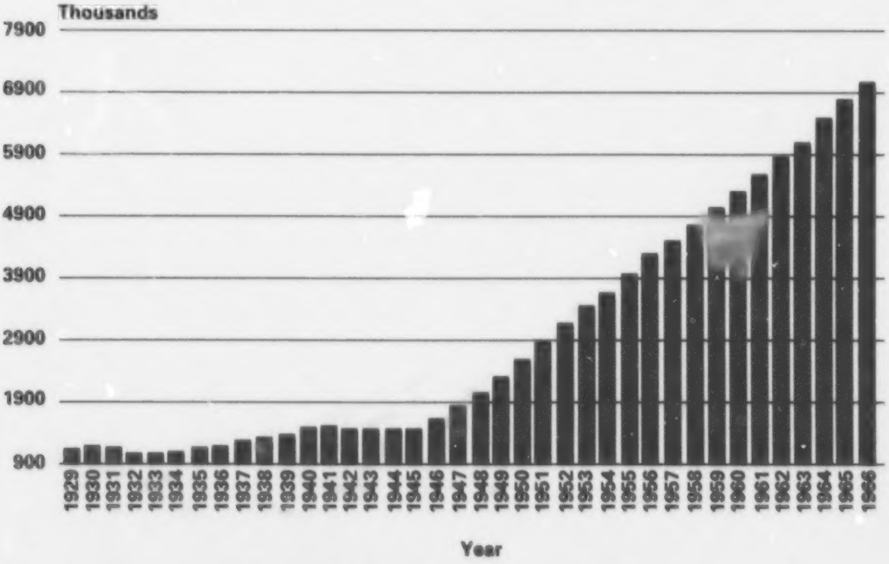
At the end of the war the desire for the car presented a classic case of pent-up demand. The war years had brought full employment, and the nation had quickly climbed out of the depression. Under normal circumstances the aged fleet of cars possessed by Canadians would have been turned in over a period of years. New buyers would have entered the market as economic circumstances warranted. As we have seen, however, car production was halted during the war. It was thus the railway that reaped the benefits of wartime travel. The demand for the car continued to build, however, and in the post-war period the car was no longer a luxury but a necessity.

The only thing that was required to release this pent-up demand was prosperity. That came. The period from 1945 through the later 1960s was one of the most prosperous in Canadian history. The average Canadian's standard of living would double in these years, and one of the things that Canadians saw as an absolutely necessary part of that rising standard was a car. After more than 15 years of practically no growth Canadian car registrations exploded following the war (see Figure 18). In 1946, despite limited production of cars, registrations increased by 74,000; in 1947, by 136,000. By 1952 registrations were double those of 1945. It was estimated that more than 50 percent of Canadian families owned a car by then. "In other words," said one contemporary observer, "it required only seven . . . years to duplicate the motor vehicle production and ownership achievements of the previous 45 years."[188] That was just the beginning. A decade later car registrations had doubled again. In 1945 one in eight Canadians had owned a car. By 1954 it was one in four and by 1965 one in three.

Patterns of ownership also changed. First, class ceased to be a serious barrier to car ownership. By the 1960s all but the very poor owned a car, and other factors, such as age or disability, were more likely to prevent car ownership than income. Second, regional variations in per capita ownership decreased. From the beginning, Ontario had had more cars per capita than any other province. In 1945 that was still the case: Ontario had more than twice as many cars per capita as, for example, Quebec. In contrast, by the mid-sixties the differences between provinces were relatively small.[189] The car had become a mass phenomenon.

Critics have railed against the car of the 1950s. They have pointed out, with some reason, that it was overpowered, ridiculously unsafe and a polluter. Such criticisms did not reflect the popular mood. North Americans felt a tremendous attachment to their cars in the post-war decades, for however far it fell short of the ideal, the 1950's car was a great improvement over what had gone before. It was more powerful, smoother riding, heated and, after the mid-1950s, often equipped with a radio. The average worker of 1955 could afford a car immeasurably superior to that of his parents. Moreover, for the suburban family the car was essential. No other alternative was competitive in time or money for the thinly populated suburbs. In other words, the love affair with the car starts from a practical base.

*Figure 18*
AUTOMOBILE REGISTRATIONS



**Source: Derived from Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series T147-194.**

The 1950's car wasn't just a practical appliance. The decades immediately after the war were dominated by the belief that what was modern was good. The old dusty ways of the Victorian era or, more recently, the staleness of the depression were to be swept aside by new technologies and new designs. The old represented poverty at home and appeasement and lack of confidence abroad. The new ways and new technologies symbolized the massed technological inventiveness of Western society — the same inventiveness that had won the war.[190] This was a technological age, and the car was the item of technology closest to the average citizen.

Modernist enthusiasm was focussed as much on design as on technology. There was a belief that post-war democracies were building a new society from the ruins of war and depression. The ranch-style bungalows, the modernist buildings that dotted the cities and the grand physical projects like the St. Lawrence Seaway and Trans-Canada Pipeline reflected the faith that progress came through modern techniques applied to the physical environment. Design reflected what has aptly been termed the "populuxe syndrome" — imitations of luxury on cheaply designed mass-production items.[191] There was also an element of insecurity beneath all the rhetoric about progress and development. The ownership of family assets meant a great deal to a generation of Canadians brought up in the substandard housing of the Great Depression or in the overcrowded housing market of war.

The appeal of the car was that it so neatly combined these two deeply felt characteristics of the age — faith in technology and insecurity. On the one hand, the car, with hydro-glide transmissions, swept-fin styling and a great deal of chrome, was the primal example of the populuxe age run rampant with such suggestive names as Strato-Chief, Rocket '88, Bel Air and Biscayne, it was deliberately associated with both technology and luxury. On the other hand, the car reflected the desire of the post-war generation to raise their families with a degree of comfort and security unknown when they themselves were children. "Give Your Family Big Car Dependability," ran one Chevrolet ad, with a picture of parents and two children cruising along the inevitable open road.[192] Ford blatantly sought to capture the hopes and anxieties of the age when it wrote its own version of the history of the car in a one-page ad entitled "Escape to the Greenbelt." It was a story of inner-city decay and violence contrasted with suburban peace and tranquillity. "The whole population is moving from the stone and steel of the city toward the fresh air, the light, the trees and living space of the suburbs."[193]

As the above ads indicate, car advertising was selling a way of life. Practically without exception the car and its proud owner were depicted in country settings. Usually there was a married couple, occasionally with others present as well. The settings were always pleasant, often in the fall (when the new models came out) and often associated with such activities as picnics and sports. Typical was a later General Motors ad depicting a man fishing in an idyllic brook in a wooded glen. On the bank of the stream is his new Chevrolet. "When George Martin goes fishing," reads the copy, "he gets away from his worries. He forgets about missiles [this was 1961], taxes and the other problems that are a part of daily life."[194]

The road, the corollary to the car, appealed to many of the same values. It too was the product of technology and sought to transform the quality of life through physical development of the infrastructure. When the Gardner Expressway was first announced by Metro Toronto Council, the *Telegram* ran a one-word headline: "Whoosh."[195] The speed and freedom of the car meant nothing without the road designed to handle it.

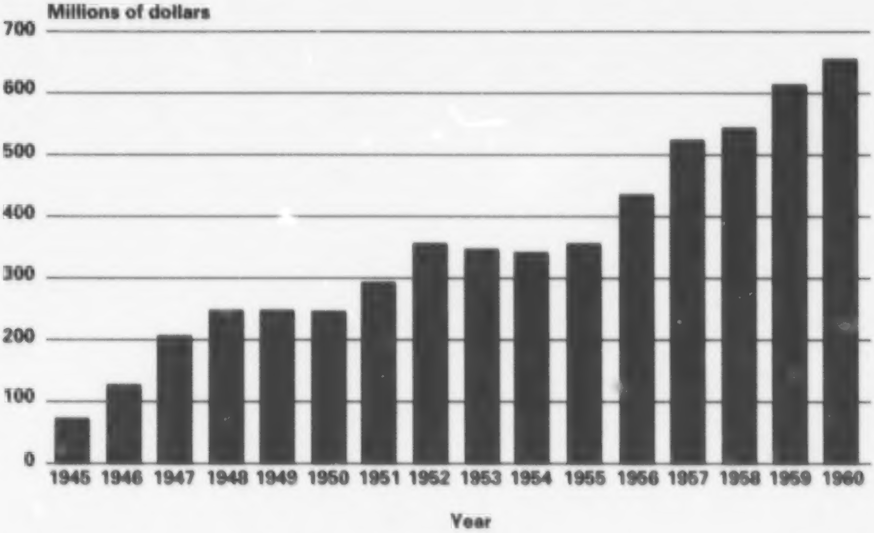
On a more practical level, highway traffic had now become so important that good roads were an important aspect of economic prosperity. Indeed, the rhetoric about the importance of a good road infrastructure is reminiscent of earlier debates about railways. A 1956 Ontario government study argued that "there is a direct relation between the level of economic activity and the volume of highway travel," and then proceeded to set up a chain of cause and effect that rested on good highways. "Increasing industrial, agricultural and mining output, as well as expansion of commerce and tourism, are all promoted by highway transport. In turn, they generate new requirements for better highway facilities. The higher standard of living and more leisure made possible by expanding production are reflected in increased motor vehicle ownership and travel."[196] A Quebec report shortly after the war made the relationship even more stark. Highways, it said, are "of primordial importance for the future development of our Province."[197] R. O. Swain, head of the International Federation of Highways, saw even more far-reaching implications during a speech in Toronto in 1954. "The highways of tomorrow will provide an efficient and effective distribution of goods and commodities sufficient to generalize better living for peoples in all walks of life." It was not just goods however. "With the highways of tomorrow will come a better and closer relationship between Canadians of the East and the members of your own family in Western Canada. Likewise, all of you will enhance life with a closer and friendly spirit of cooperation with your neighbors in the Western Hemisphere."[198]

From a later perspective what is striking in the rhetoric of roads and cars between 1945 and 1965 or so is what might be termed the "absence of doubt." In more recent decades, as we shall see, the car's proliferation has generated heated debate. Environmental concerns, urban desires to preserve neighbourhoods, and a reaction against the free-wheeling materialism of earlier decades have created a counter-image to the powerful concepts of freedom and open road evoked by the car. The 1950s and early 1960s were not given to such discussion, however. This was an age when the concept of pollution was sufficiently undeveloped that architects designed "living garages," a sort of combination family room-garage. This way one could combine those modern symbols, the car and the TV, in one room![199] The concern was not with constraining the vehicle but that highway construction keep up. One Minister of Public Works summed the mood up after complaining about the way in which car production had overwhelmed Canadian roads. "I do not contend that it is a bad thing to make motor cars; only that it is a bad thing that we cannot adequately serve motor cars with modern roads."[200] It is a statement that summed up the road policy of two decades.

These post-war attitudes had a dramatic affect on government policy and the state of Canadian roads. In 1945 user taxes generated $119.8 million from motor vehicles, considerably more than the $73 million the provinces spent on roads. Fifteen years later a buoyant economy and large increase in registered vehicles had increased the user taxes to more than $530 million. As Figure 19 shows, however, the provinces had increased expenditures even more, to $657 million. Thus user taxes accounted for roughly 80 percent of expenditures.

A couple of trends are apparent in these figures. First, continuing a tendency that went back to the 1920s, the provinces were assuming an ever greater share of road costs. Provincial expenditures rose roughly nine times in the 15-year period after the war. In contrast, municipal expenditures had risen only 2.25 times. Second, from 1945 to 1960, transportation-related items were the single biggest cost of the provincial governments as a whole, representing about 22 percent of total expenditures. In 1975, by contrast, health, education, and social services all outranked transportation. Truly the 1950s were the age of infrastructure improvement.[201]

*Figure 19*
*PROVINCIAL ROAD EXPENDITURES, 1945–1960*



**Source: Derived from *Canada Year Book*, 1945–1963.**

Aside from saying that this was a period of rapid development, it is difficult to describe in a coherent manner exactly what was done in the period from 1945 to 1965. One of the difficulties is that at mid-century there was a disparity among provinces in the number and quality of existing roads. Southern Ontario was already fairly well paved even before the war began. In contrast, when Newfoundland entered Confederation in 1949 it was still impossible to drive across the island and there were practically no paved roads outside of the immediate vicinity of St. John's. There were also extensive differences within provinces. British Columbia's lower mainland was also well served by roads, but much of the interior was impassable part of the year and served even in summer only by dirt or gravelled roads.

Still, allowing for some generalization, there are certain distinct patterns discernible.[202] This was a period of road improvement rather than one of new roads. The overall road mileage in Canada in 1965 was roughly the same as it had been two decades earlier. What changed was the quality of main and secondary roads as curves were straightened, surfaces upgraded and level crossings eliminated. There were also shifts of emphasis as time went on. In the first years (roughly to the mid-1950s) the emphasis seems to have been on the increase of paved mileage. The provinces sought to extend the sort of roads that already existed around large cities to link smaller cities and towns. Paved mileage in Ontario, for example, increased by some 50 percent between 1945 and 1955. Other provinces, starting as they did from a lower base, had even more impressive percentage gains.[203]

By the late 1950s the emphasis shifted back to the links around and between the large cities. Congestion on the main arteries between large urban centres had become a serious problem. In response, planners and governments looked to multi-lane divided highways, or freeways. In 1945 the only inter-city divided highway in Canada was the Queen Elizabeth Way (QEW) between Toronto and Hamilton. It had opened in 1937. Even after six years of post-war construction there was only 202 miles (325 km) of freeway in the nation, practically all of it in Ontario. By the mid-1960s the system had expanded to 1,646 miles (2,649 km).[204] Many of the highways most familiar to motorists throughout Canada were planned and constructed in the 10 years from the mid-fifties to the mid-sixties. These include Ontario's Highway 401, begun earlier but completed only in the early 1960s; the 403, linking the 401 to the QEW in Toronto; the Laurentian Autoroute, constructed in the late 1950s; the Sherbrooke Autoroute, constructed in the early 1960s; the twinned Highway 2 in Alberta between Edmonton and Calgary; the twinned highway eastward from Vancouver toward Hope; the Manitoba Ring Road and the Queensway in Ottawa.[205] Nothing was more symbolic of the changes that had taken place since the war than the appearance across Canada of these limited-access, high-speed, divided highways.

Though there is no "typical" province, the experience of Quebec in these years illustrates the type of activity that went on. Until the period after World War II, Quebec's efforts at road construction had been intermittent. There were several reasons for this. First, the number of car owners was much lower in Quebec than in Ontario. At the beginning of the war, for example, Quebec had 225,000 motor vehicles, compared with more than 700,000 in Ontario. Second, government philosophy emphasized the virtue of the parish and rural life and did not put a high premium on development that would link the countryside more closely to the town. Further, the same conservatism meant that government tended to move reluctantly into large-expenditure areas.

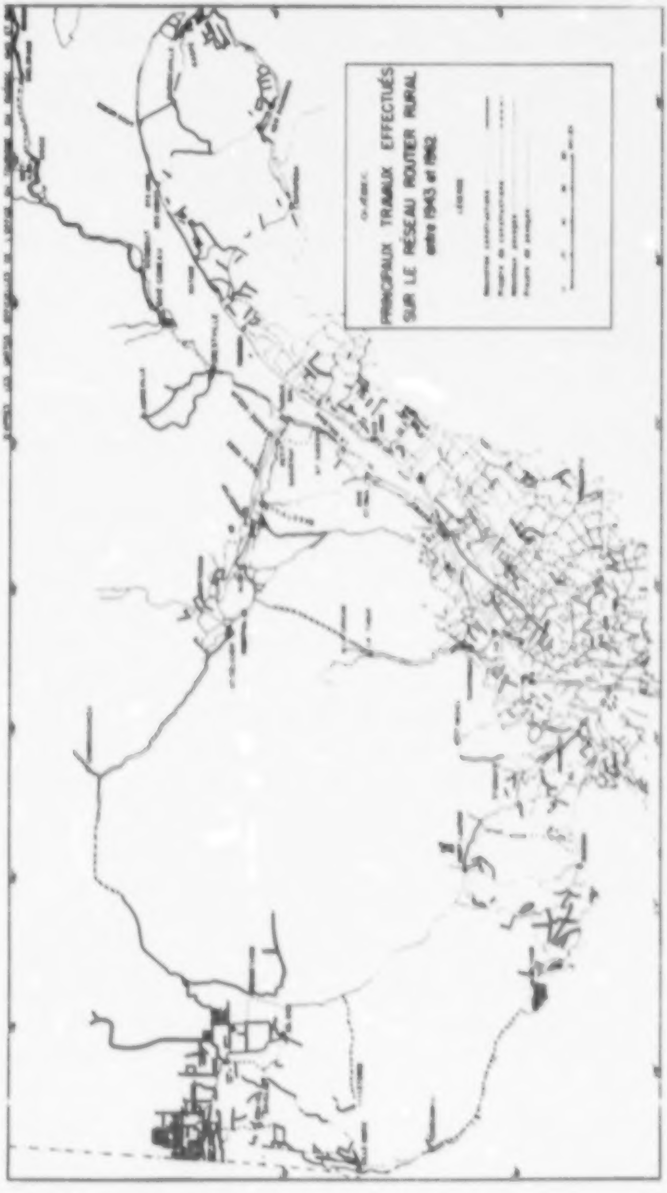
In 1944, however, a government commission investigated the state of Quebec roads. It found them abysmal outside the larger metropolitan areas and detrimental to trade, tourism and even to the prized rural life. There was an element of politics in this, as the Union Nationale party had just been restored to power and could blame its predecessors, the Liberals, for the ills that beset Quebec roads. Still, the report was essentially accurate. As of 1945 only about 10 percent of Quebec roads were paved, and only about 50 percent had any surface other than dirt. Likewise, only about 10 percent of roads outside of municipalities were kept open in winter. The great majority of road mileage was still seasonal, rough and inappropriate for the modern car.[206]

Such a situation was increasingly intolerable. The end of the war saw an upsurge of car ownership in Quebec, as elsewhere in the country. Even the valued rural farmer, as the government admitted, was increasingly dependent on good roads both for the marketing of goods and as a social amenity. As a result the government embarked on a program to reconstruct the roads of the province. In 1945 the budget for provincial roads was $25 million. By 1955 it was more than $93 million.[207] The emphasis was initially on improving rural roads. Created partly as patronage, partly from philosophy and partly out of necessity, the government program nevertheless accomplished a great deal. As Figure 20, which is a reproduction of the original map, indicates, by the mid-1950s major improvements had been carried on through the Gaspe region, the Saguenay region and the Laurentians. Quebec could boast that almost 25 percent of its total road system was paved, the highest in the country.[208] It was now possible to drive from new Brunswick to the Ontario border on modern, paved roads. Likewise, at least in the southern part of the province, most farmers were only a few miles at most from pavement. Equally dramatic improvements had been made in winter accessibility. By 1956 three quarters of the province's road system was open all year round.

By the late 1950s the original impetus of the 1944 plan was losing steam. The road system to the parishes was much improved, but, as with elsewhere in the nation, serious problems of congestion were developing around the major cities. Montreal's problems were especially acute. Traffic from the city northward to the Laurentians tripled between 1937 and 1954, and even though improvements had been made to the road system there, congestion was a major problem. In 1957 the government adopted a novel approach — or perhaps reinvented an old one — to resolve the growing

*Figure 20*

**MAJOR WORKS CARRIED OUT ON QUEBEC'S RURAL ROAD NETWORK BETWEEN 1943 AND 1962**


QUÉBEC
PRINCIPAUX TRAVAUX EFFECTUÉS
SUR LE RÉSEAU ROUTIER RURAL
entre 1943 et 1962

**Source:** Michel Bérard, *Les Routes du Québec* (Quebec Department of Roads, 1964), p. 41.

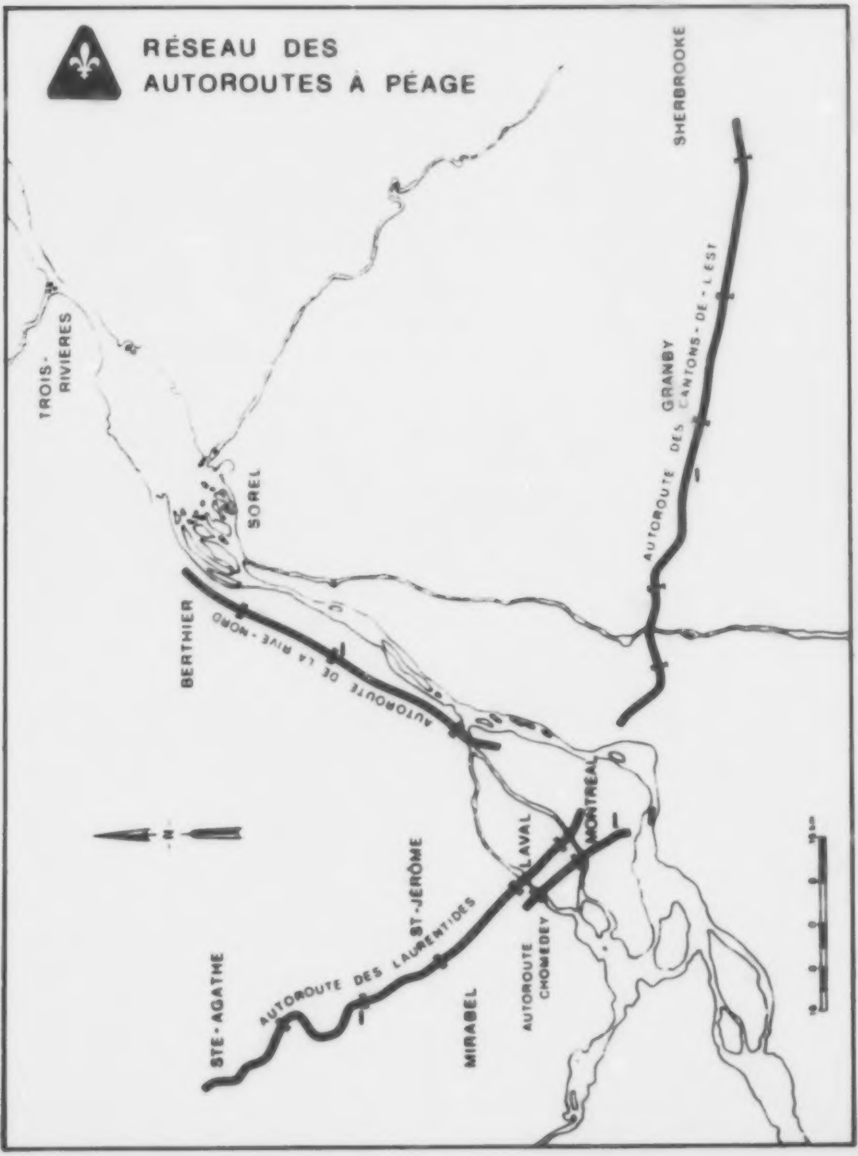
difficulty. The Laurentian Autoroute Authority (LAA) was formed. This was a private body that, with funds borrowed from the government, was to construct a modern, divided, six-lane highway from Montreal to Saint Jerome. LAA built the 39-mile (63 km) Autoroute by 1959 and operated it as a toll road. As with the 19th century toll road, the idea was that the public would pay for superior service, in this case a 70 mile per hour (110 km/h) uninterrupted trip to Montrealers' favourite holiday spot.[209] With the completion of this route the LAA was given an expanded jurisdiction and began construction on highways south of the St. Lawrence. Eventually a complex of autoroutes became a basic part of Quebec's road system (see Figure 21 which is a reproduction of the original map).

Quebec nicely represents the problems of uniqueness and generalization in any discussion of roads. It was unique in its governmental philosophy and in its reliance on a semi-private road authority for some of its projects. At the same time it typified the general Canadian pattern outlined above. Initially the emphasis was on expanding the network of paved roads beyond the major centres. Then, by the late 1950s and early 1960s attention shifted back to the problems of major urban centres and the congestion that had become a part of life there. Also, like other jurisdictions, Quebec responded with the freeway solution. Multi-lane divided highways with high speeds and limited access seemed to provide the key to the future.

Whether in Quebec or in other provinces, the massive transformation of Canadian highways did not take place without problems. A massive allocation of government funds and national physical resources were dedicated to highway construction in the years after the war. As one speaker said to the Canadian Good Roads Association (CGRA), the 1950s were "the most frantic period yet" in the history of road building.[210] The problem was not a lack of money. This was a buoyant time for governments and the public seemingly had great enthusiasm for road construction. A survey taken in 1954, already a year of significant construction, asked if the public would be willing to pay higher taxes to generate additional construction. The answer was two to one in favour of the idea. One Highway Minister commented, "there is no government that is held back in its road and street programs by an unwilling public or by rebellious taxpayers."[211]

The problems came mainly from the sheer demand put upon physical and human resources. Provinces, especially smaller ones, had to build up the requisite staff of experts to handle the complex engineering issues of modern

*Figure 21*
*Network of Toll Roads, Quebec*


RÉSEAU DES
AUTOROUTES À PÉAGE
SHERBROOKE
TROIS-RIVIERES
SOREL
BERTHIER
AUTOROUTE DE LA RIVE-NORD
AUTOROUTE DES CANTONS-DE-L'EST
GRANBY
N
MONTREAL
LAVAL
ST-JÉRÔME
AUTOROUTE DES LAURENTIDES
STE-AGATHE
MIRABEL
AUTOROUTE CHOMEDEY

**Source:** Map reproduced from Office des Autoroutes du Québec, *Rapport d'activités*, 1981, p. 5.

road-building. This was a time when engineers were in short supply, however, and it was often very difficult to get or keep skilled and experienced road engineers. The same was true of skilled labour. In addition, during the the Korean War (1950–53), the Government imposed allocation rules for vital goods such as steel. As a result many provinces had to delay bridge-building programs considerably.[212] The provinces desperately tried to keep up to public demand. It is hardly surprising, therefore, that pressures began to develop for the Dominion government to take an active role in highway development.

## THE HIGHWAY CRISIS AND THE FEDERAL PRESENCE: 1949–1967

Until the 1950s, federal involvement in road-building was sporadic. The various Canada Highway Acts of 1919 to 1928 had allocated $20 million to assist provinces in the years after World War I. In the 1930s roughly $30 million had been spent on a road program designed to assist the unemployed. During and after World War II, however, the federal government had withdrawn from most road construction. From 1946 to 1949 federal highway expenditures averaged less than four percent of that of the provinces. Indeed, cooperation between provinces had been much more significant than between federal and provincial governments. For one thing the CGRA had evolved into a quasi-interprovincial forum on highway policy. Provincial ministers of highways or their equivalents routinely headed the organization, and provincial funding supported it. The Good Roads Technical Council provided a liaison branch on highway specifications, construction methods and surfacing materials. There was also direct interprovincial cooperation on the necessary details of highway construction. A road to the provincial border was quite useless, after all, if it didn't connect with another road.

By the early 1950s the provinces were clamouring for assistance. Several arguments were used to justify the demands upon the federal government. First, roads on a modern scale had not been envisaged by the framers of the Constitution, and assistance was therefore needed. Second, the federal government reaped various fiscal benefits from the improved road system. Not only were there excise taxes on cars and, during the war, federal gasoline taxes, but the commerce that generated federal taxes depended on the road system being built by the provinces. As A. R. Morrison, President of the Canadian Automobile Association, said at one point, road construction has always been based on a user-pay philosophy. "Those who benefit from roads should pay for them." The Dominion benefitted and the Dominion should pay.[213] Third, there were even attempts during this Cold War period to borrow American precedents and argue that a good road system was key to national and civil defence. "Should atomic warfare break out, there is only one defence for civilian population — flight. Transportation itself is not the problem. The entire population of our cities could be moved if there were roads to carry the vehicles."[214] It is doubtful that any specific argument carried much weight. Their urgent repetition, however, did convey the sense of crisis felt by the provinces as well as the message that there would be little complaint about federal invasion of provincial jurisdictions.

The post-war years did bring greater federal involvement in road construction. At the end of World War II there was a strong inclination on the part of federal ministers and officials toward central planning. The Rowell-Sirois report still echoed in the mandarinate's ears, and at the 1945 Dominion-Provincial Conference on Reconstruction numerous plans were put forward to implement new programs. In a very practical sense, the federal government had the money. Despite the debt created by the war, post-war revenues were healthy. The Government ran surpluses nine out of the 10 years between 1947 and 1957.[215] Available money allowed the officials of the day to follow their inclinations! In other words, the general climate at the federal level was right for a positive response to provincial concerns.

The highway issue also had a specific appeal for the federal government. The Canadian highway system was, as has been mentioned, regionally oriented. This was understandable given that it was the provinces that were doing the planning. For a long time, however, car enthusiasts, road planners and federal officials had lamented the absence of a meaningful cross-Canada highway. By the 1950s it was theoretically possible, at least in summer, to make the trek from coast to coast. It was not practical, however. The east-west connections were generally weak and in parts of the country non-existent. Anyone travelling from east to west invariably headed south of the border. The dream of a national east-west highway, however, was a natural one for a generation that was nationalist and inclined toward big developmental projects.

The Trans-Canada was first mentioned in its new form at the 1945 Dominion-Provincial Conference on Reconstruction as one of many schemes for the post-war period.[216] Unlike many other ideas at the conference, though, it was not killed by provincial opposition. In 1948 a more specific proposition received support from most provinces, and in 1949 Robert Winters, the

Minister of Reconstruction, presented a bill to Parliament.[217] With support from all sides of the House, the *Trans-Canada Highway Act* became law in December 1949.

The parliamentary discussion on the bill is revealing. This was a project in which national pride and symbolism rather than commerce dominated — national unity, trade, public demand and national defence were all given as good reasons for the immediate pursuit of the highway project. Though it would never command the federal resources of its 19th century counterpart, there was a sense that the road was the 20th century equivalent of CPR. "The fathers of confederation," said one MP, "realized that the building of a railroad was a national responsibility. I believe the government should realize that the building of a trans-Canada highway is also a national responsibility."[218] This was echoed later by the minister in charge of the project. "Our undertaking is the largest East-West construction project since the building of our Canadian Pacific and Canadian National Railways."[219]

The bill itself was straightforward. As with many other federal-provincial programs, there was a cost-sharing arrangement. The federal government agreed to pay 50 percent of the costs on approved highway projects. The Department of Reconstruction was initially the federal agency involved, but when Robert Winters moved over to Public Works he took the Trans-Canada project with him. To be approved the project had to fit into the overall Trans-Canada route. Construction would have to meet specific standards set by the federal government after negotiation with the provinces. The federal government would have no proprietary interest in the highway after it was built and no responsibility for maintenance.[220] The maximum federal contribution under the bill was to be $150 million, and the completion date was set for December 1956. By the end of 1950 all provinces except Quebec and Nova Scotia had signed the agreement; Nova Scotia signed it in 1952; Quebec, in 1960. In the meantime, though, Quebec built its east-west provincial highway to the general standards set out in the Trans-Canada specifications, so Quebec's delay in joining did not really affect the progress of a Trans-Canada system.[221]

The possible rate of construction as stated in the agreement was unduly optimistic. Given the already extensive highway program in most provinces, it was impossible to shift sufficient resources to the Trans-Canada in time to complete it by 1956. Provinces dedicated resources and effort to the Trans-Canada only in proportion to the way it fit provincial priorities. Thus, for example, Saskatchewan and Manitoba saw the development of a first-class east-west highway link as highly desirable and made considerable progress. For Newfoundland the highway and the federal funds provided a much desired opportunity to have paved highway communication across the entire island, but limited local funds and the poor state of the provincial highway system made it impossible to move too quickly. On the other hand, Ontario was interested mainly in the Trans-Canada in the south and did not devote effort or attention to the difficult stretch around the Great Lakes. British Columbia faced a horrendous task through the mountains and proceeded slowly. Finally, even had the will been there, the amount of money and time needed were greater than original projections had suggested.

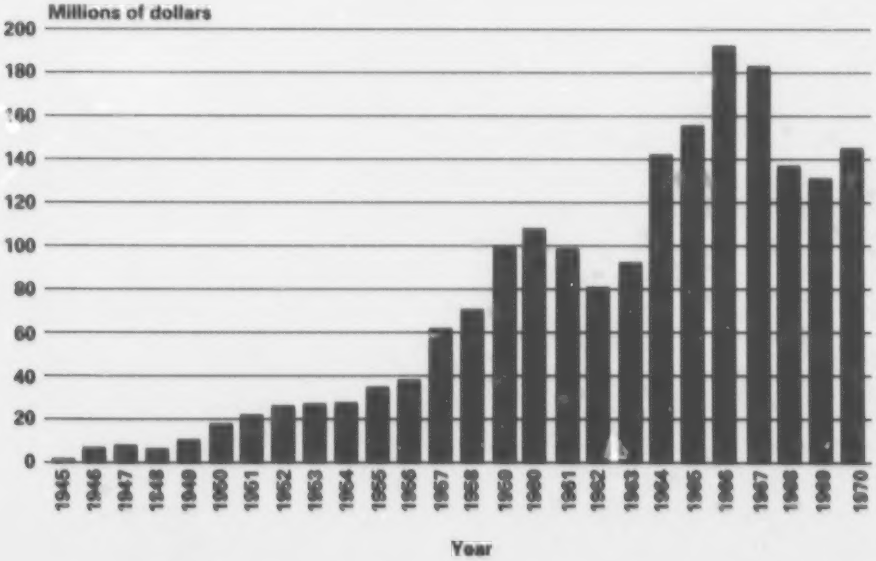
After early brave pronouncements on the progress of the highway the federal officials soon became worried. Unless the provinces "markedly step up their efforts," warned the Department of Public Works in 1954, very few would complete the work by the deadline.[222] By 1955 the "very few" provinces had become none, and by October of that year a federal-provincial conference was called to amend the agreement. It was a sign of the fiscal health of the federal government and its commitment to the project that it not only extended the deadline for completion to 1960 and increased the amount of money available but changed its funding formula as well. Robert Winters, the Minister of Public Works, noted that there was real lack of progress in many of the provinces on about 10 percent of the mileage. In most cases this was the most difficult or lowest priority section of highway — around the north of Lake Superior in Ontario, for example. In response Winters created what became known as the 90/10 formula: the federal government would pay 90 percent of the cost on 10 percent of the mileage within any given province.[223]

This broke the logjam. All sections were now tackled and real progress was made even on the most difficult sections. Still, it was expensive and time consuming. The federal government had to increase its contribution to $350 million in 1959 and to $400 million in 1960. It extended the deadline time and time again. In 1962 it held a lavish and much publicized opening ceremony at Rogers Pass.[224] In fact, though, this was public relations more than reality. It wasn't until the late 1960s and several million dollars more had been spent that the Trans-Canada Highway was fully completed. Still, by the time of the Rogers Pass ceremony it had finally become possible to drive through Canada on "passable mileage" from sea to sea.[225]

There were other federal road projects. With the Trans-Canada still under way, the new Conservative government of John Diefenbaker began the "Roads to Resources" program in 1958. The fiscal arrangements were the same as with the original Trans-Canada proposal: a 50 percent cost-sharing arrangement with the provinces. In a sense, however, this program was a precedent in its own right. Unlike the Trans-Canada project, which was focussed on a particular route and a particular nationalist goal, this program was open ended in terms of roads and brought the federal government into a project that was potentially open ended in terms of commitment to provincial highway programs along the frontiers.[226] It is also a prime example of what was earlier termed the absence of doubts. Neither government nor opposition nor interest group raised the sort of environmental and sociological questions that such northern projects would create in later decades.[227] Thus for the next 10 years the Roads to Resources program poured another $75 million dollars into provincial road-building schemes.[228]

The Trans-Canada project and the Roads to Resources program seemed at the time to indicate that the federal government had committed itself to a significant ongoing presence in road-building. As Figures 22 and 23 show,

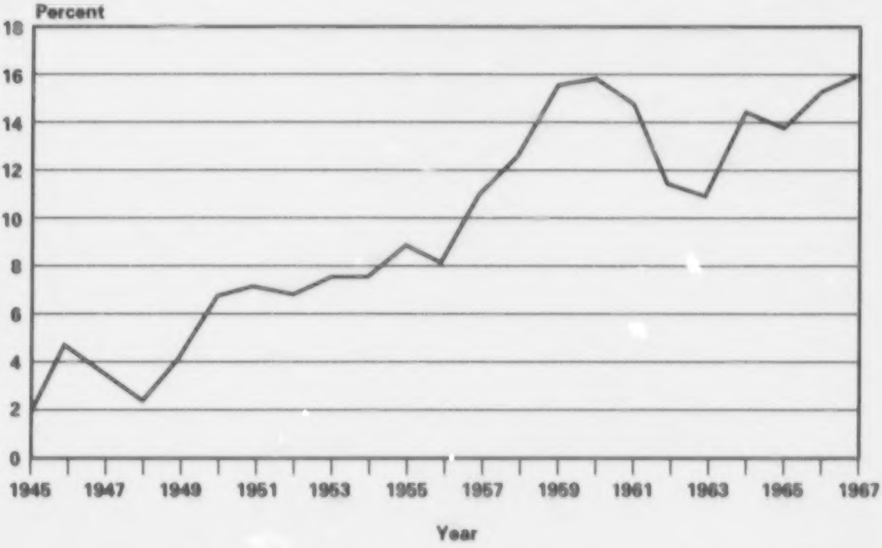
*Figure 22*
*FEDERAL EXPENDITURES ON HIGHWAYS, 1945–1967*



**Source: Statistics Canada, *Road and Street Mileage and Expenditure*, Catalogue No. 53-201, for years 1945–1970.**

*Figure 23*

THE GROWING FEDERAL CONTRIBUTION TO HIGHWAY COSTS: FEDERAL EXPENDITURES AS A PERCENT OF PROVINCIAL



**Source:** Statistics Canada, *Road and Street Mileage and Expenditure*, Catalogue No. 53-201, for years 1945–1968.

the contributions of the federal government to roads had been going up steadily in both absolute and relative terms through the 1950s and early 1960s. The relative figures are especially significant, given the fact that provincial expenditures had been increasing at a rapid rate throughout this period. More and more it looked as if the pattern of centralization that had seen road expenditures move from locality to province was continuing, this time with the growing presence of the federal government.

Yet the principles underlying federal involvement in roads were vague. Federal involvement really came about because there was the money to get involved, because there was a hue and cry for help from the provinces, and because certain major projects appealed to federal politicians and planners. Though the provinces were increasingly dependent on a federal presence in road construction, there was nothing here that was not more or less ad hoc. Should any or all of the above conditions change, federal involvement could easily shrink back to minor levels.

## THE AIRPLANE

Airline travel as a mass phenomenon is a very recent event. As of 1962 nearly 60 percent of adult Canadians had *never* been on an airplane. Even in 1976 a full third of Canadian adults had never flown.[229] Given these figures and given the high percentage of people who travelled only rarely, it would seem that even after 20 or 30 years of extremely rapid expansion the airplane was a form of transportation reserved under normal circumstances for the well-off traveller and for the business executive whose company saw the extra costs as worthwhile in terms of time saved. Nevertheless, rapid growth in the 20 years after the war provided a new source of competition for the railways. They had already lost much of their local and feeder traffic to the car. Now, at the other end of the market, the airplane was an ever more potent alternative.

Commercial airline service on a small scale dates back to the 1920s in Canada. Bush pilots ferried customers to locations inaccessible by railway or car. Municipalities developed rudimentary airstrips to encourage the development of local flight. In the 1930s business interests, including the railways, attempted to develop a national airline under the title of Canadian Airways Limited. Government had an interest in all of this preliminary activity and wanted to encourage some sort of coherent domestic system that had a chance of survival. Given this and given the dominance of the railways in passenger transportation, it made sense to organize air travel as an extension of the two giant railway concerns. The idea was that CNR and CPR would put up the capital and create something like a reorganized Canadian Airlines. That failed because CPR had no desire to move into a corporate structure involving a large Government presence. By this time C. D. Howe, the Minister of Transport, was enthused by the idea of a national airline, however, and he pushed forward an organization in which the new national airline, Trans-Canada Air Lines (TCA), would be a government body, wholly owned by Canadian National Railways.[230]

There is a large element of the ad hoc in the way this all unfolded. The Government decision to create a new nationally owned transportation corporation at a time when CNR losses were seriously affecting the national debt seems curious indeed. It can be explained only by the fact that initially there was supposed to be a large element of private capital; by the fact that the Minister of Transport, C. D. Howe, was an enthusiast for such schemes; and by the widespread assumption that the airline business was, after all, a fairly small-scale enterprise. Before the war, TCA's operating expenses were less than 3 percent of Canadian National's. During the war TCA slowly expanded operations to meet demand. Not surprisingly, such expansion was severely limited by the demands the war placed upon the economy as a whole.

Thus, at the end of the war, commercial air travel was still in its infancy. Indeed, from the perspective of the 1990s, the growth of air travel after the war dramatically emphasizes the technological and commercial revolution that has occurred in the past 45 years. As of December 1945, TCA's total fleet consisted of 11 Lockheed 14-08s, 14 Lockheed Lodestars and three DC3s. Total seating capacity for the entire fleet was 369 people! The airline carried 183,000 passengers, or one third of one percent of the number of people the railways carried that year. TCA had only 5,299 route miles (8,528 km), and several major Canadian cities were not yet served by air at all.[231]

There were good reasons for this primitive service, aside from the disruptive effects of the war. Airline travel was fast, of course, but it was still relatively uncomfortable and unreliable. None of the aircraft commercially licensed in Canada were pressurized. This meant that oxygen masks had to be broken out for flights over the Rockies. These limitations, coupled with the harsh vibration of the twin-engine piston propellers, created a real necessity for that airsickness bag (which is still there as an anachronism in modern flight). Weather could prove a serious problem for even the most hardy. Because aircraft could not climb above weather, they were often grounded by it. Longer flights, especially in winter, often arrived many hours, or even days late, if they left at all. The public responded by avoiding the plane in the winter season, contributing to an amazing 44 percent differential between summer and winter traffic in the years immediately after the war.[232] Even when there were no problems or delays, longer flights were hardly speedy by today's standards as the following morning transcontinental flight schedule for 1945 indicates.

**Trans-Canada Air Lines**
**1945-46 Flight Schedule**
**Montreal to Vancouver**

| | |
|---|---|
| 8:25 a.m. | Depart Montreal |
| 9:10 a.m. | Arrive Ottawa |
| 10:55 a.m. | Arrive Toronto |
| 2:10 p.m. | Arrive Kapuskasing |
| 4:20 p.m. | Arrive Armstrong |
| 5:55 p.m. | Arrive Winnipeg (CST) |
| 7:20 p.m. | Arrive Regina |
| 9:55 p.m. | Arrive Lethbridge (MST) |
| 12:00 a.m. | Arrive Vancouver (PST) |

Source: National Archives of Canada, Record Group 46, Series DIII, Vol. 656.

In the years immediately following World War II, however, the airline companies moved aggressively. Both TCA and Canadian Pacific Airlines (CPA) made large-scale purchases of new equipment, though Government restrictions meant that CPA's mandate was primarily international rather than domestic. The Canadair Northstar was introduced in the late 1940s in an arrangement, partly subsidized by Government, to provide the aircraft company with peacetime work. The Northstar was faster and larger than earlier planes, with a seating capacity of 40. It was also pressurized. This allowed easier flights over the Rocky Mountains and better escape from weather patterns. The duration of flights from Montreal to Vancouver decreased from 16 hours to 13 hours. The Northstars also allowed the introduction of commercial trans-Atlantic flights, with planes travelling to London from Montreal in 15 hours by 1947.[233]

The Northstars were followed through the 1950s by more advanced planes. The 60-seat Super Constellation was first delivered to TCA in 1954. It was the largest commercial plane ever licensed in Canada and was such a novelty that some 30,000 Canadians lined up at airports when the airline put it on public display. It was followed by the Viscount (1955) and the Vanguard (1960). All of these planes represented significant improvements in comfort, cost-effectiveness and speed. Yet all were introduced within 15 years of the end of the war. In 1961 the arrival of the first DC-8s brought commercial jet travel to Canada.[234]

The investment by the airlines was supported by growing Department of Transport investment in facilities. Navigational supports, airstrips, terminals and an improved meteorological service all developed rapidly to match the changing technology and growing demands of the airplane. As Table 4 indicates, Department of Transport capital expenditures on air services multiplied nearly ninefold in the decade 1951 to 1961. By the end of that time there were 120 airports operated by the Department.[235] It was a level of subsidization that caused bitter resentment among railways.

*Table 4*

*TRANSPORT AIR SERVICE CAPITAL EXPENDITURES*

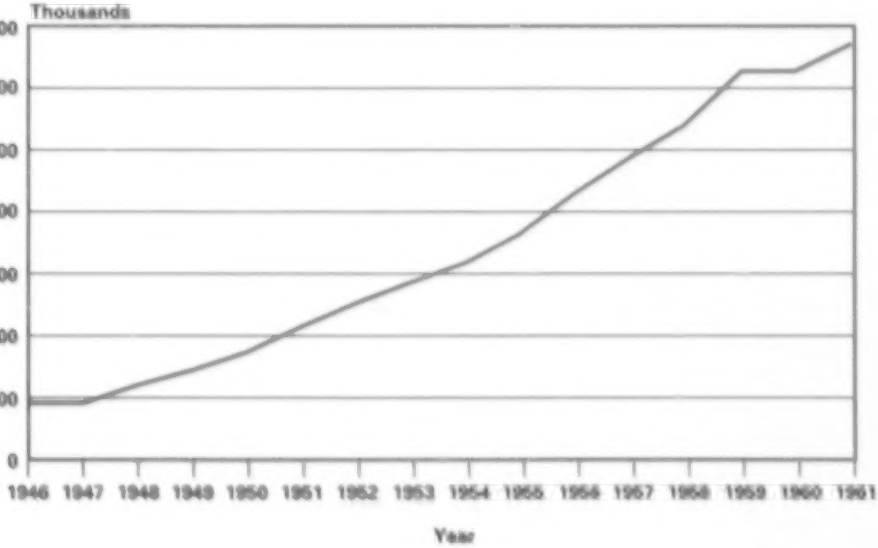
| Year | ($000) |
|---|---|
| 1951 | 8,625 |
| 1952 | 9,896 |
| 1953 | 12,141 |
| 1954 | 14,742 |
| 1955 | 25,625 |
| 1956 | 32,952 |
| 1957 | 46,018 |
| 1958 | 63,003 |
| 1959 | 64,555 |
| 1960 | 63,420 |
| 1961 | 73,534 |

**Source: Canada, Department of Transport Air Services, *Canada in the Jet Age, A Report on a Study of Department of Transport Air Services Needs, 1962–1972*, November 1962, Appendix.**

The investment in equipment and airports helped create the most important statistic of all, a tremendous increase in passenger travel. Each year after the war there were new customers. TCA's 183,000 passengers at the end of the war increased to 427,967 by 1947, even before the Northstar was fully in service. By 1949 this number had increased to 648,574. By 1954 it was 1,438,349, an eightfold increase in a decade. Route miles of the airline increased from 5,299 (8,528 km) at the end of the war to 8,362 (13,457 km) in 1950. By then most major and intermediate Canadian cities had scheduled air service. Henceforth airline expansion was concentrated domestically on increased frequency rather than on new routes. The growth of international connections across the Pacific (CPA) and to the West Indies (TCA), however, expanded international mileage.[236]

As these figures imply and as Figure 24 further demonstrates, the growth in air travel was tremendous in the 15 years after the war. At the war's end, air travel was still an uncommon experience for Canadians. Senior business and government officials used it under the pressure of time. Tourism was developing, but it was still the rare family that in 1948 or, for that matter, 1953 would pack the children into the Northstar and head off across country. It required a sense of daring, above average-affluence and probably distant relatives before people thought of travelling as families on the plane. Most Canadians had never been on an airplane. By the end of the 1950s that was changing. Air travel was not yet the practically universal phenomenon it became by the 1970s. Still, it was by 1960 a common form of business travel and was seriously affecting the railway in that market. Tourism was expanding as well: families were lured by the introduction of holiday packages, southern routes and more comfortable aircraft.

*Figure 24*
NUMBER OF AIRLINE PASSENGERS

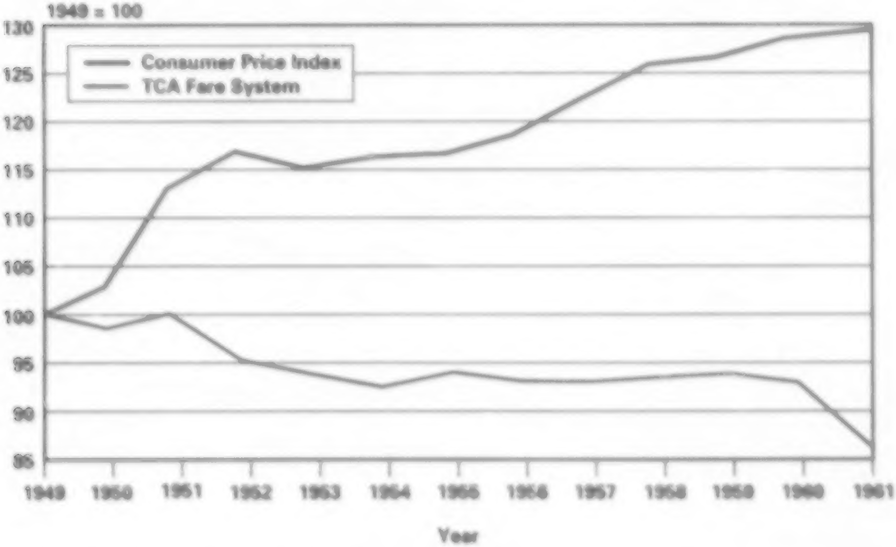


Source: Derived from Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series T198.

Contributing to this growth, and resulting from it as well, was the rapidly declining real cost of air travel. Until well into the 1950s air fares were quite high and thus reserved for those with expense accounts or unusually high incomes. Air travel might have been faster than the train, but it was also considerably more expensive.[237] Throughout the 1950s those costs kept coming down. Economies of scale generated by larger airplanes and increasing passenger volumes meant that airlines could absorb increases in the cost of living, whereas railways could not. Thus in 1954 TCA could boast that "there has been no major fare increase by TCA since 1947" and that "It is the Company's aim, within the bounds of economic stability, to make air travel financially available to more people."[238] By the 1960s the introduction of tourist and then economy fares lowered the cost of air travel still further. Now TCA could boast that Canadians had "the lowest air fare structure in the world" and could back it up with a chart that showed the plummeting real cost of fares since the war (see Figure 25).[239]

*Figure 25*

*INDEX OF TCA FARES VERSUS CONSUMER PRICE INDEX, 1949–1961*



Source: Trans-Canada Air Lines, *Annual Report*, 1961.

The perception of the airplane and air travel during the years of growth was complex, though firm conclusions await full-length study. This perception combined a number of ideas, some of them contradictory. The airplane represented adventure. For most individuals the idea of airline travel was still exciting and a little daunting. Even after the Viscounts, Vanguards and especially the DC-8s made travel comfortable and routine, the memory of the earlier noisy planes, unpressurized cabins and vulnerability to weather remained in the public mind. There is also the simple fact that the idea of going up in the air was anything but routine when the majority of the populace had never done so.

This was not the image airlines wanted, and through the 1940s and 1950s their ads downplayed adventure. In fact, the advertisements downplayed the entire experience of travel. Instead they emphasized one of two things. The first approach was to stress the technological advantages of air travel. Advertisements talked about the newness, superiority and design of the latest airplanes. The second, and more common, approach was to ignore the travel experience and technology altogether in favour of emphasizing the point of destination. The message was significant both for what it conveyed and for what it ignored. The airline could take you almost instantly to a reunion with friends, loved ones or tourist spots far away. For the most part, however, they did not really pretend they would do so in great comfort or that the actual act of travelling would be a highlight of your vacation or business travel. The romance of the airline, then, was not in the mode of travel but in the destination.[240]

The message got through. By the 1960s the miniscule competitor of the 1940s had become a serious challenger to railways. There was now one airline passenger for every five rail passengers. Moreover, those airline passengers were being drawn from two very important market segments. First, the airlines were pulling away the long-distance traveller, the one least likely to turn to the car as an alternative. Second, they were drawing the affluent business traveller, the regular user both of the train and of luxury services like sleeping and dining cars. The car had done much to destroy the train's hold over the short- and medium-haul passenger. The airline prevented the railway from holding control of the long-haul market. Increasingly the railway, which had possessed a near-monopoly on land travel only a generation before, was without a certain market for its product. This meant that the passenger business, never a very profitable aspect of railways, was beginning to stand out as a very expensive activity.

Even so, airline expansion has to be kept in perspective. It would take another major era of growth before the airplane overtook the train as the most common form of intercity public transit. By the early 1960s the first great flurry of growth in air travel was over. The airlines had reached the limits of their current market, and the phenomenal increases of the 1950s slowed down to staid growth rates of 3–4 percent a year through the recessionary early 1960s. This slowdown came just as the airlines were investing heavily in jets, and the volume-based profits of past years gave way to operating losses. The expenditures, the slow rates of increase in passenger numbers and the losses all meant that the airlines had to pause to take stock through the first part of the decade. The airlines were discovering other factors affecting their ability to cover the travel market. The growing size of airplanes, the development of jet service, and the loss of passengers to continually improved cars and roads made short-haul flights to regional centres unprofitable. Technology also forced change. By the late 1950s the new, larger aircraft could not land on the runways of some of the smaller airports. As a result TCA began, for the first time, to abandon centres. In 1961, for example, it made moves to shut down routes to a number of Manitoba and Saskatchewan communities.[241] By the 1960s, therefore, the first great phase of airline expansion was over. For at least the next several years the inroads the airlines made into the intercity market were modest. Not until the 1970s did the next era of significant expansion begin. By that time the railroads were already beginning to retreat from the passenger business.

There is a final point to be made about the development of air travel and that is that there was little effort to develop an integrated train-plane system. From the beginning the planes competed with rather than extended the railway network. There is a certain irony in this, given that initially both TCA and CPA were subsidiaries of railway corporations. In part this was a reflection of Government attitudes. As Studnicki-Gizbert has noted, transportation policy in Canada was "modally oriented" and often seemed designed to keep the various services separated rather than integrated.[242] In part this may have reflected the traditional view that railways were too powerful and needed control rather than extension. At any rate, despite the existence of the Department of Transport and despite the nominal ownership of TCA by

CNR, airports and air services developed apart from rail services. Even the partial exception of CP's fleet of ships, trains and airplanes made little difference to the outcome. The ships were being sold off, and the passenger rail service was declining in frequency and importance.

## THE POLITICIZATION OF THE RAILWAY PASSENGER ISSUE

Perhaps surprisingly, railway passenger service was not a particularly sensitive issue until well after World War II. Of course people had always wanted railways to run in their communities or regions, and the assumption had been that such lines included adequate passenger services. There was also a recognition by the railways that passenger services of high quality were expected. If the railways forgot, they were quickly reminded. Thus when CNR president Donald Gordon considered reducing transcontinental service after the war, he backed off because it hurt the public image of the railway to even consider such cuts. "Its impact on our freight service was much greater than expected. We saw that our analysis of what might be called the psychological effects of our cancellation had not been good."[243] Nevertheless, until the 1950s neither the railways nor Government focussed on passenger traffic policy. It was an issue largely buried within the more contentious problem of freight. Once the question of passenger rail did emerge as a distinct issue, however, it quickly became politicized. For underlying it were not only economics and local community service but also highly volatile regional and nationalist sensitivities. These sensitivities shaped the railway and government response to the new competitive era that existed and led directly to the current policies and problems of passenger rail.

The relationship between passenger service and regional grievance is especially important in understanding what has happened since 1950. Of course, regional concerns have always played a part in railway policy. As we saw earlier, the Canadian government gave support to the Intercolonial, the Prince Edward Island Railway and CPR in response to regional concerns. Even after the railways were completed, regional politics often seemed to be railway politics. Yet, except for the past few decades, passenger service was not a part of this debate. Only as that service went into decline did the regions of Canada make the issue of adequate passenger service a matter of regional equity. Once they took up the issue, however, they could draw upon a rich tradition of regional rhetoric about the proper role of railways.

They could also point to policy precedents in which railway activities had been constrained in the name of regional concerns. That tradition involved freight rates; accordingly, discussion of passenger transportation and regional grievance must begin not with passengers at all but with freight.[244]

Both the Maritimes and the West have been very much involved in the regional criticisms of the railway system and of Government policies toward railways. The precise timing and nature of their concerns have been different, however. In the West many of the battles were fought and resolved before the turn of the century. From the beginning there was a tremendous dislike of the monopoly position of CPR. The lack of competition allowed the railway to make arbitrary rules on, say, loading and unloading grain unless the Government intervened. It also enabled the railways to set rates much higher in the West than in the East. In the 1880s, for example, general freight rates in Manitoba were about 50 percent higher than in Ontario. There were also a great many complaints about the absence of branch lines. CPR's policy in this area reflected a sensible, even cautious, policy of building only as traffic warranted. To the pioneer settler or local business on the frontier, however, the railway was the lifeline to the outside world, and it was natural that they would press for more rapid extension of the railway network.

By the beginning of the 20th century the West had achieved many results from its continual political agitation. The Crowsnest Pass agreement in 1897 set fixed rates (the Crow rates) for the hauling of grain and eased Western concerns in that crucial area. At the same time, the government further recognized the national importance of the relationship between the railways and the wheat economy by passing such legislation as the *Manitoba Grain Act*. Then, of course, the new transcontinental railways broke the monopoly of CPR and increased the area of the region easily reached by railway. By the 1920s the West was relatively well covered by branch lines, and though everybody loved to hate CPR, Western grievances had turned to other issues.[245]

In the Maritimes the timing was different. Discontent with the fruits of Confederation had created an on-again off-again series of complaints about regional issues. That discontent, however, had abated somewhat in the prosperity of the Laurier years and, at any rate, had never been focussed on the Intercolonial Railway in particular. By the 1920s, however, the grievance was much worse. The Maritime economy was shrinking relative to the rest of Canada, and while other parts of the country enjoyed a reasonable prosperity by 1923, the Mariti[illegible] remained mired in recession. The situation had deteriorated so bad[illegible]oth political and economic terms that a royal commission (the Duncan Commission) was appointed to investigate Maritime grievances.[246]

By now the Intercolonial Railway was very much a focus for Maritime discontent. This was due partly to the animosity generated by freight rate changes shortly before World War I and partly to the absorption of the railway into the new CNR system. There was more to it than that, however, for the railway was a symbol of what Confederation had promised to the region and not delivered. This view, which remained fairly constant, was neatly summed up by a Nova Scotian submission to the Duncan Commission.[247] Whereas, the presentation concluded, the Province of Canada had numerous reasons to support Confederation, Nova Scotia had only two: "1. That an Intercolonial railway be built." and "2. That in general, and specifically as a result of the building of that railway, these provinces were to share in the internal commerce which the creation of the Dominion was intended to promote." As the trade was not up to expectation and as, indeed, the Maritimes had declined economically since Confederation, the region was entitled to further support on "equitable and national grounds."[248]

The claim is an interesting one, for it ties the fate of the railway and the charges by a railway not to a specific legal argument but to an historical intention or assumption. It was no longer sufficient that the railway was built and operated; it should be built and operated in such a manner as to overcome regional disabilities. The concept of the railway as a political instrument of regional equalization is clearly expressed here. Moreover, the principle was accepted, at least implicitly. In the wake of the royal commission the Dominion government passed the *Maritime Freight Rates Act*, which directly subsidized Maritime railway shipments as a part of the national arrangement.[249]

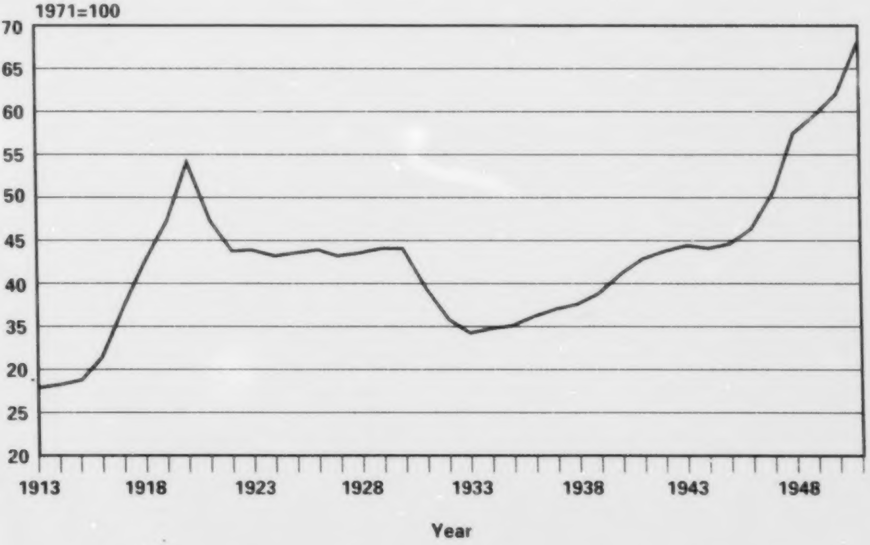
The Crow rates and the subsidy clauses in the *Maritime Freight Rates Act* therefore were precedents for treating railway charges not as instruments of profit and loss but as national policy instruments in the face of regional concerns. Nor was there any doubt about the right of the the Board of Railway Commissioners to determine both freight and passenger charges. In so doing they took "equitable treatment" and other such issues under consideration. Generally, however, the Board did not see its mandate as extending in a very broad way to issues of regional equalization. Nor did it see that as something for which the railways were responsible. "Railways are not required by law," it wrote in one decision, "and cannot in justice be required, to equalize natural disadvantages such as location, cost of production and the like."[250] There were thus two somewhat antagonistic principles at work within the governmental and public perceptions of the railway's role. All agreed that equitable rates were desirable, and this was worked towards throughout the 20th century. At the political level, however, and especially in the East and the West, railway rates were seen as instruments of a broad national policy that transcended the interests or rights of the individual corporation.

After the Duncan Commission the whole issue of freight and passenger rates became less controversial. This was due in large part to the simple fact that rates were not increasing. In the wake of the inflation of World War I there had been a series of rate increases approved by the Board of Transport Commissioners. Thereafter, however, the regulated passenger and general freight rates remained unaltered. (The first-class passenger rate was 3.45 cents per mile except in the mountains, where it was 4 cents a mile.)[251] The maximum proved profitable for the railways as the general price level declined after 1920. During the Great Depression, of course, railways found they had to lower rates much below the maximum allowable in order to generate business. During World War II, as we have seen, wage and price controls were in place. Besides, the railways made a healthy profit within the existing standards. Thus, though there was a regulatory system, the rate levels had been set so generously in the 1920s that in effect market rates, not regulation, determined passenger and freight tariffs between 1921 and 1945.

After World War II all that changed. As rates again became unstable they again became more political. As wartime price controls came off, inflation increased and for the first time the price index rose above what it had been just after World War I. The Korean War, which began in 1950, added to inflation. As Figure 26 indicates, for the first time since the years immediately after World War I there was a significant increase in the cost of living in Canada. Two additional factors made this increase in prices worse for the railways. First, there was a growing discontent in the workforce. In the immediate post-war years a series of labour disputes disrupted railway traffic and increased labour costs. Second, the railways were faced with daunting capital costs. Deferral of capital purchases during the Great Depression now came back to haunt the companies. In addition new technologies, such as efficient diesel locomotives, appeared necessary if the companies were to operate efficiently. The conversion process, however, would be an expensive one.

The old standard rates quickly came under pressure in such circumstances, and the Board of Transport Commissioners was faced with a series of requests for adjustment. There were freight rate adjustments of 21% in 1948, 8% and then a further 16% in 1949, and 20% in 1950.[252] The increases reawakened the regional concerns that price adjustments had always brought forth. When the freight increase went before the Board in 1948, seven of the nine provinces objected. Both national parties passed resolutions expressing concern, and the Government responded by appointing a royal commission on transportation (the Turgeon Commission).

*Figure 26*
*CONSUMER PRICE INDEX, 1913-1951*



**Source: Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series K8.**

The Turgeon Commission was the last one in which passenger issues remained marginal. As it noted, there were only a few isolated complaints about the quality of passenger service, largely from the island provinces, and one complaint about passenger fares from British Columbia that cited the mountain differential rate built into the standard fare. In this latter case, however, the railways accepted the idea of abolition and the differential rate soon disappeared.[253]

Despite the limited attention it gave to passenger transportation, the Commission is of importance here for two reasons. First, the Commission marked the return to the political arena of the hotly contested battles of the 1920s on regional equity and railways. Much of the same rhetoric was used and, if space allowed, one could show how provincial submissions returned to practically all the concerns of the earlier years.[254] The origins of the Commission, which as it somewhat tartly pointed out were definitely political, demonstrate what one critic has termed the "ideology of freight rates."[255] Second, the Commission is important because in its recommendations it supported a principle that in recent years had been used by the railways in their application for freight increases — cross subsidization. The sharp rise in expenses and the decline in passenger services were a growing concern of the railways immediately after 1945. At that time they did not seem to have had any intention of eliminating or even sharply reducing passenger services. What they did do, however, was argue that passenger service losses should be considered in freight rate increases. Freight rates, in other words, should subsidize the passenger service. The Commission agreed. "The freight and passenger services are essential and if the passenger fares cannot be raised to produce sufficient revenues to enable the passenger traffic to pay its own way the freight traffic must bear the burden."[256]

There are several points of interest in all this. First, the regional position on passenger transportation was negative: both the Western provinces and those in the Maritimes saw lower freight rates as more important than the railway subsidization of passenger service. This continued the long-standing practice of emphasizing freight while taking passenger service for granted. Second, the Turgeon Commission represents a break from the past in that the railways were now becoming concerned about their rising passenger deficits. That anxiety had prompted the railways to at least raise the question of subsidization of their passenger service. Third, all the parties involved seem caught between older and newer conceptions of the transportation industry in Canada: the traditional view of railways as a monopoly to be controlled was challenged by a newer view that railways were a declining industry, faced with fierce competition and a shrinking percentage of the transportation market. Regulation designed to control a monopolistic industry was now turning to subsidy issues in the face of a troubled one. Amidst all this, as A. W. Currie pointed out, the Commission "displays the confusion of objective which has characterized the history of transportation in Canada almost from the beginning." Were railways businesses, entitled to maximize profit and pursue corporate goals, or were they agencies of social well-being in which profit was secondary?[257]

Through the 1950s more and more policy makers began to realize that the competitive position of the railway had indeed changed and that this was especially true in the case of passenger services. Previously, the public had not lobbied strongly on questions of passenger routes and the Board of Transport Commissioners as well as the politicians had generally accepted railway decisions on the services to be provided, increased or dropped. All that, however, had rested on the assumption that the overall level of passenger service was likely to remain the same or improve. As it became apparent that services were shrinking affected communities, the press and apparently the public at large became more insistent that the railway should be viewed as an essential service. Cases for reduction of service or abandonment proceeded through channels only slowly and with great outcry. This left the railways caught between irreconcilable forces. Passenger services were becoming more and more of a burden. By 1958 the railways estimated their annual losses on passenger service to be more than $56 million.[258] It was no longer feasible for railways to absorb such losses or for adjustment of freight rates to cover it. On the other hand, the slowness of the regulatory system prevented railways from adjusting services in an attempt to maximize efficiency. Uncertainty discouraged investment in new plant, and the problems of discontinuance made introduction of new passenger routes a very dubious proposition. The railways remained committed tc passenger service, but for the first time in the history of the nation there were worries that railway passenger service might be unable to compete succcessfully in the intercity market.

This was clearly recognized by a royal commission on transportation established under the Diefenbaker government (MacPherson Commission). Though freight rates and their increase were the basic reason for the appointment of the Commission, it, unlike its predecessor, found a great deal of public concern about the quality and future of passenger services. Numerous municipalities and interest groups complained that declining service, actual or planned, threatened their well-being. At the same time there was also a feeling among witnesses that passenger services were too costly and that something had to be done to rationalize the system, though usually at somebody else's expense.[259] For their part the railways pushed hard to encourage a facilitated system of service abandonment and, where services "are held to be necessary in the public interest," to develop Government subsidy programs.[260]

In attempting to sort out all the concerns, the Commission started with a point not fully understood by the earlier Turgeon Commission. The problem, it concluded, was that both the Government and the public were behind the times in their conception of railways. Railways were no longer the giant monopolists of former years but faced instead a very competitive environment. Yet the regulatory system, the political arena and public pressure all worked against any flexible response by the railways. This was as true in passenger services as in freight.

> In this [adjustment to competition] they were handicapped, not only by federal regulatory requirements, but also by public pressure which customarily took the form of intense resistance to the dislocations which might be occasioned by these adjustments. For example, such matters as the removal of passenger services operating at a loss or the abandonment of unprofitable branch lines proved virtually impossible to decide with reference to normal commercial operation.

At another point the Commission noted pointedly that the railways are accused of deserting communities by withdrawing passenger-train service, when a more objective view would be that the communities have deserted passenger train service.[261]

If Canadian transportation were to adjust to the requirements of the last half of the century, the Commissioners concluded, the railways had to be given increased flexibility. They were no longer dominant in transportation and indeed, in passenger services, were now minor participants. If they were to continue to have any role in that area they must be left with the freedom to invest where they could make money and to get out of the business where there was no money to be made. The whole thrust of the Commission was thus toward deregulation and, to the extent that regulations continued, a recognition that railways should no longer be singled out for regulation not faced by other carriers.

Yet, in a significant qualification, the Commission drew upon an idea that the railways themselves had argued. Canada had always faced the dilemma of requiring certain transportation services when the market itself did not justify such services. The response had traditionally been Government support in one form or another. Now that rail passenger services seemed to be in difficulty, it was only natural to apply the principle to that sector. This would be done in two steps. First, said the Commission, there should be a transitional period of four years in which the railways would be subsidized for moving slowly to rationalize services. Such subsidies would run from $62 million in 1961 to $12.4 million by 1965. By the end of that period, however, much of the passenger service in the nation was expected to disappear. Second, railways would thereafter remain on a more selected range of potentially profitable lines and would be subsidized indefinitely on those crucial passenger lines where "no reasonable alternative public highway exists."[262]

The MacPherson Commission is significant in the history of Canadian transportation, for it marked a bold departure from past thinking. First, it challenged many of the myths about the power of railways and the public complaints that railways must provide adequate passenger services. Railways were neither as powerful nor, given modern public habits, as essential as had been previously argued. Accordingly, the Commission accepted the railways' complaints about being forced to continue services that were no longer required or profitable. Second, in the name of the public interest, the Commission altered the nature of subsidies to passenger services. Cross subsidization from freight to passenger services would not be favoured in the future. Instead, the subsidies would be direct, with the Government accepting the responsibility and the taxpayer footing the bill in instances where services were thought essential. The combination of public subsidy and service reduction practically guaranteed that passenger services, which had so recently become politicized, would remain highly controversial in the future. At the same time the assumption was that railways would significantly rationalize passenger services. The up-front subsidy should ensure that the public and politicians did not get too carried away preserving non-essential passenger trains.

Things did not work out as neatly as the MacPherson Commission or its supporters had hoped. The minority governments that characterized the 1960s hindered the introduction of new legislation and discouraged bold steps. Amendments to the *Railway Act* were prepared under the Conservative government in response to the MacPherson Commission. In 1964, under a Liberal government, a version of this bill was actually introduced in the House of Commons, only to die in committee. By that time the new Minister of Transport, J. W. Pickersgill, took the logic of the MacPherson Commission one step further. If railways were no longer the dominant form of transportation in Canada, it made little sense to deal with the problem by looking only at railways. By 1966 the Department of Transport was ready with a complicated bill designed not only to deal with the specific problems of the railways but also to create an agency that could look at the issues of transportation from an integrated perspective.[263] The result was the *National Transportation Act* (NTA), which became law in 1967.[264]

In principle the NTA adopted the concepts put forth by the MacPherson Commission as modified by subsequent public pressures and political concerns. Those modifications, however, proved to be significant. In terms of passenger transportation the Act extended the principle that the public interest had to be weighed (through hearings before the newly constituted Canadian Transport Commission [CTC]) before steps were taken to abandon branch lines or passenger services. Then, if service was deemed to be necessary despite losses, the government was obligated to pay 80 percent of such losses.

There were also important departures from recommendations of the MacPherson Commission. First, the Commission had not envisaged a "super-agency" to handle transportation matters. Second, the MacPherson Commission had clearly intended that Government support of passenger routes come into play only under relatively extreme circumstances, "where no alternative exists."[265] The NTA took a more open-ended approach, however, and included such considerations as "future transportation needs" and the politically loaded possibility of appeal to the Governor General in Council.[266] Related to this, the MacPherson Commission had not considered partial subsidies, but the drafters of the legislation were concerned that total subsidization would lead to profligate attitudes on the part of the companies. It was uncertain whether the Government, faced by contradictory arguments from the public and corporations, had decided the NTA subsidies were largely transitional to allow the rationalization and abandonment of passenger services or part of a national commitment to low-cost, publicly supported rail transit. What was certain is that with the NTA the new reality of intermodal competition and an ailing passenger rail sector had been recognized in law.

## 6. THE MODERN ERA: 1967–1990

The years after 1967 mark the most recent phase in the history of Canadian transportation and transportation policy. The many battles that have been fought over passenger transport in these years pose a danger for the historian. Never in the history of the issue have so many papers poured forth from the corporations, lobby groups and especially government. They range from careful and detailed studies of technical issues by the new Research Branch of the CTC to wide-sweeping generalizations about the importance of service by politicians protecting local constituencies. Yet from an historical perspective the period from the passage of the NTA until now is extremely brief. It is important to step back from the trees (or ex-trees now converted into memos) and try to single out the major landmarks and trends of the last 20 years.

From this more remote perspective, four things happened that set the stage for the various debates. First, within a very short time it became apparent that the Government was not going to apply the NTA subsidies stingily. The new CTC and the Government were cautious in their approach to railway abandonment.[267] Second, the railways finally abandoned any hope that the passenger business could be revived. Third, the annual cost of the subsidies increased much more rapidly than had been expected. By the early to mid-1970s the Government was seeking to extricate itself from the subsidy system. Ministerial decisions in 1976, 1981 and 1989 to reduce passenger service reflected this Government desire to rationalize passenger rail and, not incidentally, to reduce the subsidy levels. Fourth, while the Government was searching for a solution to the ever more expensive rail passenger service, a new ambivalence was creeping into policy on roads and cars. Energy crises, pollution concerns and other issues meant that an improved highway system seemed a dubious alternative as a form of passenger transportation.

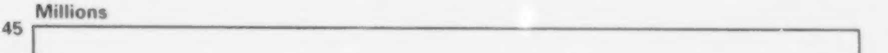
All of this activity led to considerable comment from a public that talked in one fashion and acted in another. People weren't leaving their cars to return to the rails, but they continued to see passenger rail service as desirable and viable. There was a continued attachment to railway travel even among those who rarely or never took trains. The image of the railway corporation as the rapacious monopolist of yesteryear also created scepticism about railway motives in abandoning passenger service. Had they really tried to make it profitable? Was the bad service perhaps a deliberate response to subsidization? There was also confusion because the continued success of European railway systems and the increasing success of the Amtrak system in the United States seemed to contradict the Canadian experience of the last 20 years. Each attempt to cut back passenger rail service brought an angry response. It is thus in this modern era that the dichotomy between public attitudes and Government policy is most pronounced. It is in this era as well that there is a sharp gulf between the public consumption of passenger rail services and public support for the continuation of those services.

Another characteristic of the modern era has been the increasing influence and importance of other carriers. The airline industry went through another period of growth, and by the 1980s middle-income Canadians routinely used airlines for long-distance trips. For business it had become the standard mode of travel, even for relatively short distances. At the same time the automobile became ever more ubiquitous. Between 1961 and 1975 motor-vehicle registrations doubled, to one vehicle for every two Canadians. Theoretically, everybody in the nation could have been travelling in a car at the same time and have left the back seat empty! By the late 1970s all but the poorest of Canadian families owned cars.

Such patterns are apparent only in hindsight. In 1967, nothing was yet certain. Though there were accusations that the railways were deliberately chasing passengers away, every indication is that as of 1967 the railways were still attempting to make passenger service viable.[268] Beginning in 1963 CNR undertook a number of initiatives, including a flexible system of pricing known as the "Red, White and Blue" fares. These were designed to encourage off-peak travel at lower cost. A variation of the idea was soon adopted by CPR. Both railways upgraded their transcontinental service during the decade. CNR also spent considerable money and effort trying to draw traffic on the heavily travelled Toronto–Montreal corridor. The introduction of the *Rapido* in 1965 made the route, at least according to the Company, the "fastest train passenger service in North America for a comparable distance."[269] Plans for a new Turbo train called for a further reduction in time by the end of the decade. There were also inventive new partnerships emerging as provincially subsidized commuter systems appeared in Ontario. The GO system, first appearing in 1967, marked the reappearance of an older role for the railway — carrying short-haul commuters. Commuters would form an ever-greater proportion of total train ridership through the 1970s.

There were also hopeful signs that the long decline of ridership was coming to an end. In fact, after a generation of decreases, the late 1960s saw an actual growth in the number of passengers carried (see Figure 27). A growing population, especially the large youth population of the 1960s, needed public transportation. From a low of fewer than 19 million riders in 1961, numbers increased to more than 24.5 million in centennial year. Over the next several years those numbers remained more or less stable, fluctuating between 20 and 25 million or, to put this in perspective, about one trip per year per Canadian.[270] Finally, the NTA system of subsidies *seemed* to be working as the MacPherson Commission had intended despite the cautious approach taken toward abandonment of services. In the late 1960s and very early 1970s subsidies to railways declined consistently. By 1971 railway subsidies for passenger travel had been halved to $53.9 million.

*Figure 27*
*NUMBER OF RAILWAY PASSENGERS*



**Source: Statistics Canada, *Canada Year Book*, and railway company annual reports.**

Yet all of this proved illusory. If there was ever a chance that passenger railway travel could be retained while the subsidy system was phased out, that chance disappeared with the changing economic fortunes of the 1970s. From World War II until the later 1960s Canada had experienced one of the greatest periods of sustained growth in its history. Any recessions were brief and not too severe. This meant that passenger transportation policies, whether in the public or private sector, were formed against the background of expectations of continued economic growth and prosperity. Then, in the early 1970s, the period of prosperity faded away. The 1970s were to be marked by growing "stagflation."[271] For the next decade economic growth remained unsteady and significant inflation created instability. One component of this stagflation was especially important to the transportation sector. The large-scale increase in energy prices in 1973 had ominous implications for transportation. Travel (or the carriage of goods) became more expensive relative to other activities, and Canadians curtailed travel or sought ways to make it more economical.

All sectors of the transportation industry were hurt by stagflation in general and by the energy-price shock in particular. The airline industry experienced some of its worst years ever in the early 1970s, and both the number of passengers and number of passenger-miles decreased — a very rare event in an industry known for growth.[272] North American car makers laid off thousands of workers. Consumers turned increasingly to smaller, cheaper and more gas-efficient cars. The airline and car industries, though they might suffer in the short term, operated from a position of relative strength. Their technology was still in demand. Car registrations did not decline, though people moved to smaller vehicles, and after the short retrenchment of the early 1970s, airline ridership again began to increase.

Long after the immediate impact had worn off, however, the energy crisis affected discussions of transportation in Canada. The concerns about conservation that the crisis awakened accentuated a public and official shift toward the automobile that was already under way. People would not give up their cars to any great degree, nor did the 1950s imagery of freedom and status disappear. However, a counter-image was now developing that emphasized the negative side of a society dependent on the automobile. A series of events, from safety concerns through energy and pollution concerns, meant that the "absence of doubt" that characterized public investment in roads in earlier decades disappeared. In the last couple of decades there have been all sorts of doubt.

There had always been some critics of the suburban mythology, and the lamentable safety record of cars had been a cause of concern in the 1950s as much as in other decades. In those years, however, the reply to the critics was not to fetter the car but to design it or its transportation routes better. Modern highways would provide greater safety and better separation from local streets and generally improve the quality of life. Underlying these attitudes towards progress through to the mid-1960s was the belief that technology was a positive force. The unleashing of corporate and governmental inventiveness would, as was discussed earlier, improve peoples' lives. By the late 1960s this was an increasingly challenged proposition. For the age was, in many ways, dedicated to a cynicism about material progress and to the developmental orientation that had gone before. The North American automobile, as the symbol of the modernism and technology, was bound to come under criticism.

The critique came in stages. Initially, the car lost some of its personal glory as a symbol of technology's benefits. The North American automobile, so glorified by an earlier generation, turned out to be a shoddy example of technology. The publication of Ralph Nader's *Unsafe at Any Speed* in 1965 helped create a new ambivalence toward the North American car.[273] Technological progress, said this new perspective, was largely illusory — a matter of design and gimmicks. Underlying it all was a cavalier attitude toward such basics as safety and reliability. People still loved their cars but they were no longer certain they could trust them.

A second source of concern arose because the pressure for highway development was moving to the cities. Municipal expenditures on streets continued to climb in the late 1960s even as those by federal and provincial authorities levelled off or declined. Yet the car posed real problems to urban life. The vision of gargantuan expressways bisecting city centres was increasingly unacceptable. From the politicians' point of view it was too expensive. At the unofficial level, citizen resistance grew as city neighbourhoods feared they would be sacrificed in the name of suburban traffic flow. The highly publicized fight to stop the Spadina Expressway in Toronto in the early 1970s and the debate over the "Third Crossing" of Burrard Inlet in

Vancouver made it apparent just how politically charged such issues could become.[274] Thus the combination of urban problems and contemporary sensibilities made the automobile-oriented transportation system seem increasingly dubious, at least in and around the big cities, by the early 1970s.

Neither Nader's crusades nor the urban concerns of the early 1970s, however, had as much impact as the energy crisis of 1973. Then critics of the car could claim not just that the vehicles were badly made or that urban congestion was a problem but that the very act of driving a car was socially destructive. Numerous popular books proclaimed that the energy crisis had brought the North American automotive dream to a crashing halt. One work, attacking the automobile society upon which North American development had been based for the last quarter century, even gained the imprimatur of the Governor General in the form of a foreword. It was a sign of the times.[275] So too was the new image of the car. From the symbol of freedom it had become the metaphor for rapaciousness and inefficiency. "I should like to dedicate this essay," said one critic in a book aimed at engineers, "to the majority of mankind which has no hope at all — and, I sincerely hope, no ambition, of owning an average American car. This paragon of ecological virtue has an astonishing capacity for swallowing non-renewable resources. Quite apart from its contribution to the death rate, air pollution, noise and blighting of the city and countryside, the typical U.S. car spends much of its time transporting 1.5 people."[276]

Criticism also moved inside government circles. The official Canadian position became, at least implicitly, anti-automobile. Energy conservation was, for at least a decade, a matter of official concern and exhortation to the public. An Office of Energy Conservation was established, and the Canadian government threw its support behind measures to conserve energy. The automobile was, as everyone knew, something less than energy efficient and therefore governmental efforts at energy conservation meant government efforts to downgrade the place of the car in Canadian transportation. Federal departments like Energy, Mines and Resources warned that Canadians must abandon their dependence on the car and move "from single passenger cars to multi-passenger cars, buses and trains, and greater use of public transit systems."[277] A Department of Transport study referred to the car as "the most dangerous mode [of transportation]; a major source of congestion in high density areas; inefficiently used in terms of loads and peak periods; the largest source of pollution and energy consumption;

and most subject to weather vagaries."[278] The Science Council of Canada wrote a series of reports through the decade that urged the preservation of alternative forms of transportation and warned of the impending crisis in energy supplies.[279]

We could go on with examples but the point is fairly obvious. In Canada as in the United States the basic perspective on the car had changed.[280] The critics, previously in a minority, had now become the prevailing wisdom. That wisdom could be summed up to the effect that even if the car was not inherently bad as a transportation medium (and that was a point of debate) the way the North American car culture had evolved was socially and economically destructive. Overly large cars — often used by single passengers — vast freeway systems and excessive commuting distances had created problems of safety, urban pollution, energy depletion and social dispersal. Some of these issues could be ameliorated by better and more efficient cars, but the preferred solution was alternative transportation systems. Certainly none of the problems could be solved by building more freeways. That only encouraged more cars.

The result was the end of the single-minded focus on cars and roads that had characterized the past decades. In Ontario, for example, the Department of Highways was, in 1971, merged into the much larger and diverse Department of Transportation and Communications. "Transportation today, however, is not confined to highways. It has acquired an all-encompassing role," concluded the final report of the old department.[281] Two events were especially symbolic, however. The first involved the Canadian Good Roads Association, which dates back to 1914 and, through the Ontario Good Roads Association, to 1894. Over the years it had been the centre of discussion on and support for improved Canadian roads. Yet in 1970, arguing that "we in CGRA are aware that roads alone will not solve our transportation problems," it changed its name to the Roads and Transportation Association of Canada.[282] Second, Statistics Canada had, since the late 1920s, published figures on road expenditures in Canada. The beginning of such regular information had marked the new rise to importance of the road in Canadian life. In 1976, however, it discontinued the series. It was a symbolic reflection of the decline in the perceived national importance of road construction.[283]

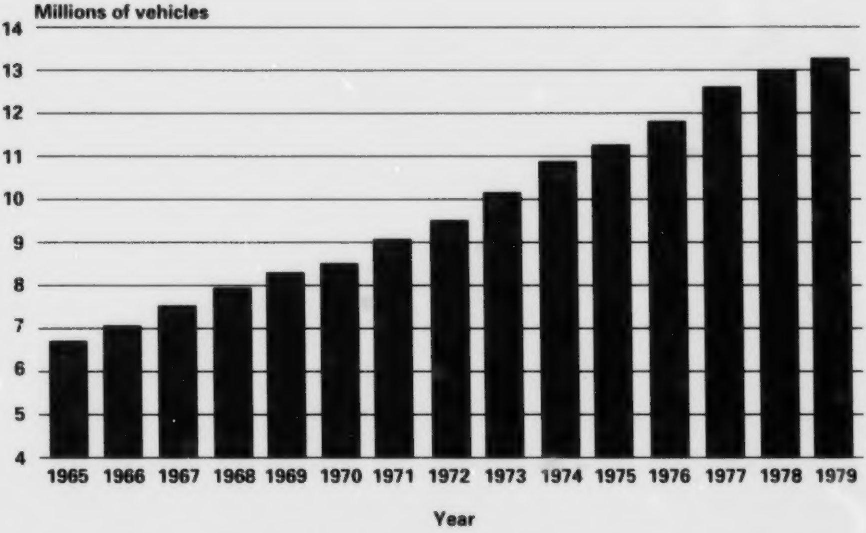
The shift, though important, must be qualified, however. The 1970s saw paradoxical pulls exerted on governments. Despite the concern with energy conservation and despite the talk of alternative modes of transportation, the number of cars continued to increase in Canada (see Figure 28). The public was not going to be wooed away from the car, and thus governments were torn between searching for alternative forms of traffic and responding to ongoing congestion on the roads. This made transportation policy difficult to define. The prevailing wisdom was to woo the people out of their cars. In some places efforts were made, with some success, to do so. The GO train system in Ontario, for example, provides a perfect example of the shifting priorities of the provincial government.[284] GO was an exceptional system, however, based in the largest metropolitan concentration in Canada. Most places had neither the provincial revenue nor the population density to support such a system.

The rise of concern about the automobile was paralleled by declining investment in the road infrastructure of the nation. As late as 1966 *Road and Wheel*, the magazine of the CGRA, proclaimed that Canada was headed for a record year in road building, characterized "by large and more complex projects." The next year the headlines trumpeted that construction had reached $1.6 billion and that the record pace was continuing.[285] In fact, however, changes were in the air. In 1967 both federal and provincial road expenditures decreased in real terms. The provincial cut was especially severe: it was the greatest percentage drop since the great boom had begun at the end of the war. The next few years saw the trend continue. In real dollars, expenditures on rural roads would not reach 1966 levels again for more than a decade (see Figure 29). Even then the recovery was short lived, and by the 1980s real-dollar expenditures had plunged once again.

The near-disappearance of the federal government from road construction was an especially dramatic aspect of the turnaround in road policy. Once the Trans-Canada and Atlantic Development grants wound up by the 1970s the federal government was little involved in highway policy. Expenditures fell in absolute terms to only a small portion of what they had been a decade before. In relation to provincial highway expenditures they became insignificant, declining from their peak of 16 percent in the mid-60s to less than 5 percent by the early 1980s and to less than 4 percent by the end of the decade.[286] The basis of involvement had also become less unified, appearing for the most part under the Regional Development program under a series of ad hoc non-legislated arrangements with provinces known as ERDAs (Economic and Regional Development Agreements). There was nothing in size or cohesion to compare with the Trans-Canada program or even the Roads to Resources program of earlier decades.

Figure 28

AUTOMOBILE REGISTRATIONS, 1965–1979

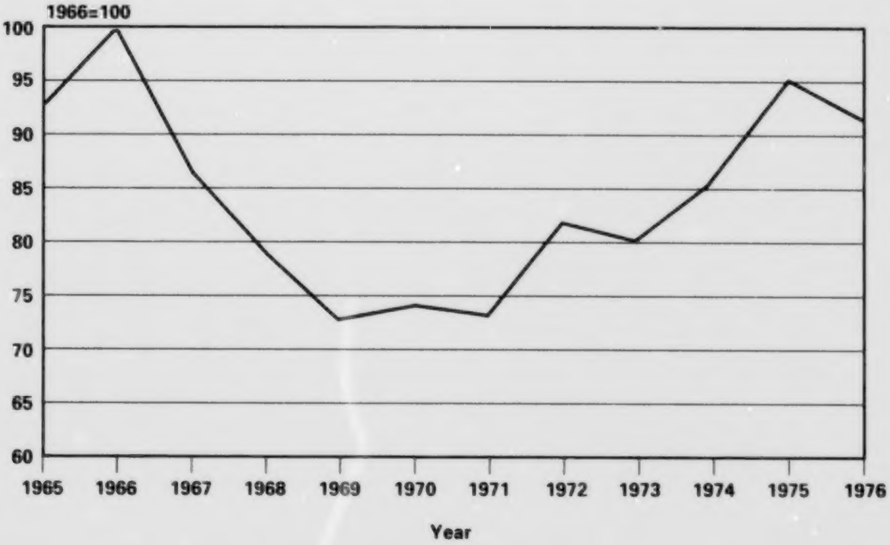


**Source: Derived from Statistics Canada, *Vehicle Registrations*, Catalogue No. 53-219.**

Growing doubts about the car culture complicated the debate over the decline of rail passenger service. As issues of energy conservation and pollution came to the fore the train was looked upon relatively favourably, especially when compared with the automobile. The railways were obviously unable to continue without large- scale subsidization and yet, as Via 2000 and other pressure groups reminded the Government, the railway was exactly the sort of alternative that the nation needed if the car was to be used more sparingly. Much of the argument in favour of the train is explicitly or implicitly based on the "social costs" of the car and hence the desirability of Government support for national rail passenger service. By the mid-seventies federal subsidies of passenger rail service were generally higher than federal contributions to highway construction. This was a reversal of orientation from the 1960s. Then the federal involvement in the Trans-Canada system and the MacPherson Report's recommendation that the federal government get out of the railway subsidization business seemed to point the way to the future.[287]

Figure 29

THE END OF THE HIGHWAY BOOM: PROVINCIAL PLUS FEDERAL REAL EXPENDITURES ON ROADS, 1966–1976



**Source: Statistics Canada, *Canada Year Book*, 1966–1978.**

Non-economic or non-direct economic arguments could be made that the railway should be preserved not in the name of nostalgia but for the social benefit it could confer.[288] Despite this, the economic instability of the 1970s was ultimately disastrous for the rail passenger industry. The decrease in travel, along with the more competitive alternatives to rail passenger service, meant that the railways' hopes of finding a core of profitable routes proved illusory. As Otto Lang, Minister of Transport in the mid-1970s, put it, "there were, in fact, no profitable routes."[289]

The absence of any profitable routes made unworkable the principles underlying both the NTA subsidy system and the CTC caution toward reduction in services. The hope had been that profitable routes could, with the assistance of conservative rationalization and subsidization, support the non-profitable routes. Now it turned out there was no cross subsidy. The railway companies were left in an economic "no-man's land," directed to maintain a high level of railway services, subsidized for 80 percent of their losses but required to pick up the difference. Moreover, even if the subsidies had been total there was still an opportunity cost. Every railway prediction was that freight traffic was going to increase continuously over the next several years. Every dollar, every locomotive and especially every mainline track that was cluttered up with money-losing passenger services prevented railways from meeting the demand on the freight side.[290] The absence of any profitable routes was equally disturbing to Government officials. The basic problem can be seen in the subsidy figures. After reaching the low point of $53.9 million in 1971 Government grants to railways began to go up. By 1973 the subsidies had increased to more than $130 million; by 1974, to $164 million. Also, an unprecedented two thirds of these subsidies were now going to passenger services. This was not something envisaged by either the MacPherson Commission or the framers of the NTA.[291]

These forces set off a chain reaction. Until now at least CNR if not CPR had maintained an interest in passenger services. By the mid-1970s, however, the railways spent most of their time trying to get out of the business. In the Government there was a growing cynicism about the future of passenger services. It was a technocratic era, and the romance of railway travel seemed to have little impact upon the Department of Transport, which looked increasingly to the bottom line cost of maintaining services for a shrinking clientele. "Described in extreme terms," said one mid-1970s study from the Department, "it would be cheaper for the government to buy a bus ticket for each rail-passenger and give it to him free of charge, than to subsidize the rail-passenger traveller as at present; and bus service is available alongside most of the rail routes involved and in the case of many routes, air service as well."[292]

Until then political leaders had been very cautious about any policy of rationalization. Jack Pickersgill had captured the flavour of the political view of railway matters when he commented in 1966 that "transportation has the capacity to arouse emotions and prejudices . . . more completely than questions of race, religion or language."[293] It is not surprising that his successors had been reluctant to pursue a policy of passenger rail reductions. The CTC, taking its cue from the political and public mood, had also been cautious in its approach to reductions in passenger service and branch lines.[294] The rising deficits and the studies within the civil service had their impact, however. By 1976 the politicians were convinced. In January of that year the Minister of Transport, Otto Lang, announced a transport policy aimed at rationalization of railway passenger service.[295] This decision, to accept the inevitable public criticism and to try to reduce the cost of railway services, is important. What Lang did was to force action on an agenda that had been in the making since the MacPherson Commission. Passenger services would be reduced and the political consequences would be accepted. A core of services, however, would be preserved and upgraded. Ever since this statement was made debate on transportation policy in Canada has revolved around the wisdom or folly of the actions put in motion that day.

Formally, Lang did two things through the policies he enunciated in January 1976. First, he instructed the CTC to look at passenger rail service with an eye to rationalization.[296] These instructions gave three basic roles for passenger trains: as short- to medium-distance carriers between cities; as commuting trains; and as transcontinental carriers providing a high level of comfort.[297] In effect, this put the emphasis on the Windsor–Quebec City corridor and on the transcontinental trains. This left the CTC with a difficult task. It did not know specifically what levels of service or subsidy the Government considered reasonable, only that rationalization was desirable. Nevertheless, the CTC responded to Lang's directive by proposing reductions in service and holding public hearings across the country. After considerable controversy and much press coverage, the CTC proposed a series of reductions, mainly affecting underutilized regional routes.[298]

The second thing Lang did was remove the burden of passenger service from the existing railway corporations. He did this by using the unusual method of an appropriation vote to create VIA Rail in 1977. In 1978 it became a Crown corporation.[299] If the Government was to revive passenger service given the disinterest of the railway corporations, such an agency made sense. It ended the pretence that railway passenger service was still a private business. The Crown corporation would, presumably, be more interested in providing adequate passenger service for the simple reason that that was its purpose. VIA was not without its critics, however. Then and since, defenders of rail passenger service have argued that VIA was without a legislative mandate, was unsupported by the Government and was thereby destined to fail to attract passengers.

The cuts and the creation of VIA were met by new counter-balancing forces. In Ottawa, and then across the country, a group of individuals drew upon a British precedent to create a lobby group in support of alternative transportation. The existence of Transport 2000 and other lobby groups ensured that in the future Government moves on rail service would face close scrutiny. The 1977 reductions in service also had an impact upon the public at large. As we have seen, the public hearings and the resultant newspaper coverage awakened public interest.[300] Certainly the hearings in 1977 generated a great deal of attention and controversy. This was especially true in the Maritimes. Both the transport needs of the region and the tradition that tied railway service to the Confederation pact made for lively discussions when the CTC Rail Committee came to the region in May 1977 to discuss rationalization.[301]

There were also forces in the public sector that began to reconsider rail service. If nothing else, there was VIA Rail. Its very purpose revolved around the provision of passenger service. Its existence, therefore, created an additional voice in support of adequate passenger service. Immediately upon organization VIA undertook a large-scale marketing campaign that succeeded in increasing ridership and operating costs dramatically in the first couple of years of operation. This emphasis not on profit but on service and ridership is reflected in the Corporation's annual reports of the first decade. These reports consistently point to the social and political significance of passenger transport. They also show that VIA is aware that its audience is the public service and the politicians rather than the shareholders of a private corporation. "Now here are we," wrote the President in the 1985 *Annual Report*, "the present inheritors of that remarkable tradition, feeling somewhat insecure or uncertain about whether the long progression is still relevant." The service still had a place however. "One can only conclude that as a nation we have not yet found the right way to think about passenger rail. Yet find it we must, unless Canada is to lose a vital link between its citizens. . . . Surely we should not break a tradition that is emotionally important to many Canadians because of its pivotal role in our history."[302]

In the meantime the public service tried to grapple with the issue. Rail passenger service was costing the public treasury a great deal of money, but the automobile's dominance continued to raise social and energy concerns. Indeed, the striking thing about Government studies in the later 1970s and early 1980s is the amount of time spent on the subject of that most anaemic of all modes, the passenger rail system.[303] In effect the controversy of 1976 and 1977 had raised in a serious way the question of the mix of transport modes in the Canadian future and had done so when the car was under greater criticism than ever before as a wasteful, dangerous and expensive form of mobility. In the latter part of the 1970s, reported the Science Council of Canada, the car "captured approximately two-thirds of the annual growth [of the transportation market], with the other third going to air travel. At a time of energy conservation this is not happy news."[304]

In the past decade the other major force driving Government policy has been the national deficit. Through the 1970s the deficit increased dramatically. By the early 1980s it was becoming a significant, negative economic force and a political issue. Simply put, cynicism about the future of rail travel drove Government policy in the 1970s. In the 1980s the despair lessened as lobby groups, VIA Rail and others began to look for ways to rejuvenate the system. Even as the fatalism toward passenger rail lessened, however, the imperatives of Government finance took over. The 1980s were not times conducive to massive and unproven investments in passenger rail technology. Instead, Government watched as total subsidies to VIA Rail increased to more than $300 million by 1980 and to more than $600 million by 1982. Attempts to reduce the deficits in 1981 met with massive public reaction, more hearings and polls that showed that the majority of Canadians wanted rail service maintained.[305] The Opposition Party commissioned its own task force and created a lively defence of railways that received considerable press and public attention.[306] The overall pressure was so great that in an equally controversial move many of the reductions in service were subsequently restored.

To some degree Government policy was floundering by the early 1980s, being pushed to and fro by contrary pressures. Public opinion ran against reductions in service, and there was no consensus among the government's advisors on direction that passenger transportation should take. Yet the rising national deficit and the rising railway subsidies prevented any sort of bold initiative. VIA Rail was widely seen, justly or not, as half a solution: a company without a mandate and without adequate funds. An Ontario task force report was especially critical, arguing that "VIA has no effective ability to operate passenger rail services in Canada, little control over systems and costs, cannot set its own budgetary priorities or effectively plan or experiment with different levels of service."[307] VIA was now by far the most expensive part of the railway system for the taxpayer, absorbing nearly three quarters of all subsidies.[308]

Against this backdrop of uncertainty, the most recent effort to break the logjam came with the newly elected Government's rapid move to alter the whole approach to passenger transportation in Canada. Feeling that the complex set of regulations and hearings inhibited innovative solutions, the Conservative government moved toward a simplified regulatory system where necessary and a deregulated system where possible. The idea was for "less regulation, leading to less government interference, [which] will encourage innovation and enterprise."[309] This policy, which was reflected in the new *National Transportation Act, 1987*, is still evolving and is therefore beyond any historical study. The new approach had effects on passenger transportation, but to uneven degrees. Rail service was not really affected that much. VIA, after all, had as its primary role the provision of passenger service rather than profit. It was cost conscious to a degree and for some time had been emphasizing "corridor services" to increase revenue. Deregulation did not change that emphasis and did not open the way to wholesale line abandonment. So long as the subsidies were maintained there was no purpose in doing so. In fact, when the next and most recent round of rail service cuts came, they did so in the traditional way and for the traditional reasons. The Government ordered the cuts made because of the increased deficit.[310] Likewise, the process of cuts engendered the same round of studies, controversy and outrage by opposition parties that had met both the 1977 and 1981 cuts.[311] All of this indicated, of course, that passenger rail service was far beyond the state where it could be considered in normal free-market terms.

There was a second effect upon passenger service, however. Deregulation had a significant impact on the airline industry. Despite the temporary setbacks in the wake of the 1973 energy crisis, the industry had seen healthy growth. Between 1972 and the mid-1980s passenger figures doubled, reaching 29 million by 1986, far eclipsing the number of train passengers.[312] The rapid shift that took place is brought into perspective by recalling that only 20 years before, five times as many people travelled by train as by plane. Thirty years before, 15 times as many did. Airline traffic continued to expand for many reasons. The standard of living had increased by the mid-1960s to the point where a larger percentage of the population could afford air travel. The improved technology and possibilities of wide-bodied jets allowed better service, as did fuel-efficient jets. Nor was flying the unknown quantity that it had been 20 years before. Most people took it for granted and used the technology freely. Increased volumes, in turn, allowed the appearance of regional airlines and smaller planes that aimed to draw smaller communities into the air network and thereby displace alternative modes of travel.

Perhaps the most important factor increasing air travel was the effective lowering of costs to the consumer with the introduction of discount fares. In the early 1970s, as part of "package vacations," the CTC allowed airlines to introduce "charter-type fares" on scheduled services in 1977. These fares, hemmed around with restrictions on booking, cancellation and time of travel, nevertheless attracted economy-conscious travellers to airlines. Then, beginning in 1979, seat sales were introduced.[313] The initial conditions became successively less onerous, especially under the trend to deregulation in recent years. Thus, even before the mid-1980s move to widespread deregulation, the CTC had given the airlines much more flexibility. As a result, rail travel and to a degree even long-distance bus travel lost much of the cost advantage they had always possessed.

When sweeping deregulation was introduced in the mid-1980s, the airline industry was by far the most affected. Accordingly, there was a great deal of scrambling as the two major carriers (Air Canada and Canadian Pacific) sought to increase their market share. There were also dramatic changes in the field as the successful charter company Wardair entered and then failed in the scheduled market. There was also the purchase of Canadian Pacific by the aggressive regional carrier Pacific Western (and later the purchase of Wardair) to form Canadian Airlines International. As well there were the rise, fall and reorganization of several regional carriers. All of this is far too recent to assess in any definitive way. Two things are apparent, however. First, the highly competitive struggle for market share brought at least a temporary lowering of real air travel costs through much of the decade, further hurting VIA's ability to compete. Second, the oligopolistic situation of the airline industry and the regulations that carefully divided up routes had provided the industry with financial security and stability for the first 40 years after the war. Obviously this is no longer the case. Deregulation, the globalization of the industry, the projected open-skies agreement and congested airports have turned stability into instability. Speculation abounds that there will be a failure of a major airline, leaving Canada with only one national carrier within a decade. It is all very reminiscent of the way in which CPR and CNR were viewed in the interwar years.[314] Certainly, no transportation system can be set up for the future that blithely assumes airlines will be able to bear the national burden any more than the railways were a generation before.

## 7. CONCLUSION: CONCERNS AND MYTHS IN CONTEMPORARY CANADA

As Canada moves into the 1990s public transportation is in a state of flux. The crisis of the railways has not been resolved, and there is still a lively debate between those who see rail services as essential to our future and those who see their abolition, at least outside the corridor, as essential to national solvency. The public seems to want better rail services but is increasingly pessimistic that this is a realistic expectation. The airline industry has probably never been so unstable as in the past few years. Corporate takeovers, the whole rise of the hub and spoke system, the controversy over the Pickering airport a few years ago and the growing congestion of places like Pearson Airport hint at limits to growth in the immediate future. Thus, though the technology of air travel will continue to be essential, it is uncertain what forms of corporate or route reorganizations will take place as the industry adapts to new circumstances. Buses continue to absorb a significant degree of travel, some of which would formerly have been undertaken by the train. Still, their services remain largely unintegrated with other modes, and over long distances they remain favoured only by those in lower economic groups. Only the automobile continues with relentless force to expand its dominance over the lives of Canadians.

This instability has led to a search for new policies, yet here too contradictory forces buffet decision makers. Lobby groups, such as Transport 2000, have continued to hammer home an effective defence of passenger rail and have been supported by other lobby groups, by opposition parties, and by other levels of government. In the meantime the Transportation Association of Canada has argued that the federal government must return to large-scale road investment if Canada's infrastructure is to be maintained.[315] The public is in the most paradoxical position of all. For it is the public's choice of transportation modes, especially its overwhelming attachment to the car, that has determined much of the policy of these years. The public is also one of the staunchest defenders of passenger rail transport. In 1981, when a series of VIA cuts were introduced, a Gallup poll indicated that a plurality of Canadians in *every* region wanted service retained or improved. Even when people were asked if they would be willing to have taxes increased to support passenger rail service, the support continued in every region except Quebec.[316] The situation had not changed eight years later. When the Government moved to reduce VIA services in 1989 a poll indicated that an overwhelming 89 percent wanted VIA continued; this time there was majority support in every part of Canada. A clear majority (54 percent) actually wanted VIA service expanded.[317]

Such support indicates that Canadians, even those who don't use the train, have a strong set of emotional attachments to passenger rail traffic. To understand why such attachments exist it is necessary to move from rational cost-benefit analysis or specific patterns of use to the realm of myth. A myth in historical terminology is not necessarily false, though it can be. Rather, a myth is a collection of beliefs and assumptions held to be true by a wide segment of the population, whether true or not. Canadian railways, because of their long history and recent controversial debates, are associated with a number of popular myths. Individual myths or elements of myths appeal to different segments of the populace and are used by different interest groups. As a totality, however, they possess a powerful collective hold over the thinking of the Canadian public and explain why policies to cut back services have been resisted so strongly.

The first and most potent of the myths is the nationalist myth. It developed around the time the Canadian Pacific was constructed. It was strengthened over the years by a combination of railway image building, public association of railway travel with "seeing the country," academic assessments of the importance of East-West links, and popular portrayals of the romance and adventure of the railway. A Gallup pollster summed up the power of this myth in response to the overwhelming support of VIA in 1989: "The trains are almost folklore in Canadian history, going back to the opening of the West and the national policy of John A. Macdonald."[318]

There are two striking things about this myth. First, though most of the railway's business and its most important national role have always been freight, it is passenger service that evokes the emotional response. It is not enough for wheat to travel East to West — people must. Second, it is striking how populist this myth is. Many of the arguments about railways are technical and are, at least in detail, for the experts and enthusiasts. The nationalist myth is something that is not determined by expertise or by the special interest groups, though of course it has been encouraged by them. It simply reappears at every point in which the public has input. The most recent example comes from the Spicer Commission's "hot line" and citizen forums. People resented the dismantling of such "national symbols" as the Canadian Broadcasting Corporation and passenger rail.[319]

Also, though all rail passenger services are lumped together under the national myth, at the real heart of that myth are the transcontinental trains. "They are," concluded the President of VIA, "a unique and historic national symbol, a means of enhancing national unity and a contributor to tourism."[320] "The closing of trans-Canada passenger service on the Canadian Pacific Railway," argued Transport 2000 recently, "is both a real barrier to communication and a symbolic attack on national unity."[321] "VIA Rail — National dream fades," trumpeted the headline in the *Toronto Star* during the most recent round of cuts.[322] Thus, public mythology can be focussed. The attachment to trains is really an attachment to passenger services and in particular to the grand tradition of the Canadian transcontinentals. Moreover, this nationalist attachment is not predicated on the belief that a rail service will save the country. Rather, it is seen in conjunction with a number of other forces as a part of the fabric of Canada.

Subsets of this national mythology exist in each of the regions. Sometimes it is purely a localized version of the national romance of railways. The 1977 cuts led journalist Jean-Paul Desbiens to reminisce about trips from Metabetchouan to Quebec City. Significantly, he saw his personal experience as part of the national experience, saying that it was "Trains: to people and to the land, a heritage. He remembers them well."[323] In most cases, as we have seen, the regional variations emphasize the relationship of that particular region and the "national compact" — a compact that includes train services. Behind this is a more general principle that in the regions emphasizes the national policy role of the railways, or what the MacPherson Commission referred to as the tradition of obligation.[324] Emphasizing this aspect of the railways subordinates profit or economic rationalization in favour of regional equity and national policy. As well-known Manitoba historian W. L. Morton testified before the MacPherson Commission, regulation of railways "was necessary to ensure that railways indeed fulfilled their role in national policy by providing the various regions of Canada with railway services on terms and rates equitable as between the public and the railways and as between the different regions of the country." An economist from

Saskatchewan saw the national myth by definition as uneconomic and therefore argued that railways should not be thought of in purely economic terms. "It is from the attempt to reorient trade from its economic pattern that most of our subsequent difficulties have arisen."[325]

A second and quite different myth exists about rail passenger service. This, for lack of a better term, might be referred to as the "if only" myth. The argument here is that in fact rail passenger service is viable if only some certain steps are taken or some previous arrangement had not been made. If only tracks were upgraded to allow faster service. If only car users had to pay their fair share of road costs. If only the railways had not charged VIA such exorbitant rates for running rights, old rolling stock and so on.[326] The list could go on, but the basic point can be made in one citation. "We agree with Transport Canada that current rail service is untenable. The erosion of passenger services is real but given the virtual neglect of the rail mode over the past twenty years, it was inevitable."[327] In one form or another all the "if only" myths rest on the belief that the decline in rail service came from neglect, bad planning or hostile, air-minded bureaucrats.[328] Also essential is the corollary belief that good planning, effort, investment and a far-sighted government can turn the decline around.

The interesting thing about this myth is that unlike the previous one it is testable in normal economic and planning terms. Cost-benefit analyses can be done on technology improvements, alternative routings, integrated stations, an altered VIA mandate and so on. What makes this a myth and not just a proposition to be tested is its endlessly varied possibilities. Either side in the debate can easily maintain a position for or against rail travel whatever proposition is proven or disproven. Other issues are simply introduced. As a parliamentary committee reported in exasperation during the 1989 debate on cutbacks, "the Committee was confronted with a plethora of divergent statistics put forward by various witnesses with great persuasion and conviction. . . . The observation the Committee would like to make is that statistics can be used to make anyone's case or position sound persuasive."[329] The statistics are just a subset of the whole "if only" debate. What is important here is not the truth or falseness of any particular assertion (though ultimately it is very important) but the very persistence of the debate. It reflects a widely held belief that neither the railways (for reasons of policy) nor the Government (for reasons of cost) has given passenger service an adequate opportunity to prove itself.

The third myth could be described as the social-benefits myth, and its characteristics borrow from both of the other major myths. The argument here is that whether or not passenger rail travel could be made profitable, it is worth the subsidy for social reasons. The 1970s argument about passenger service in an energy-conscious community that we have already discussed is a primary example of the myth of social benefits. More recently energy has become less of an issue, but another environmental issue, pollution, has replaced it as a focal point of discussion. Such environmental issues are joined by a myriad of others, some more reasonable in their claims than others. Thus, for example, train service is often seen as a means of transportation equity: the poor, elderly, and those with disabilities or from isolated communities are more likely to need the train than others. Regional equity is also involved, but more important recently has been a hinterland-metropolis approach in a more general sense. The marginal communities, whether in small-town Ontario, the Maritimes, or the North, are seen as dependent on trains in a way that large urban centres with good airports and roads are not. A 1977 editorial in the Toronto *Globe and Mail,* "Count the Social Costs Too," which condemned reductions of train service into Sudbury, perfectly illustrated this very potent concern. Cost efficiency, it said, left the Northern communities feeling "abandoned, neglected." Subsidies were especially necessary to prevent "inconvenience to thousands of small communities." Then, in an appeal to the national myth, it concluded, "We would never have built the railways if Otto Lang had always been in Transport."[330]

As was just mentioned, the social-benefits myth touches upon both the national identity myth and the "if only" myth. Canadians are well attuned to the general themes of pollution, energy consciousness and regional equity. To the extent that these themes are hammered home by supporters of passenger rail, therefore, trains become a "good thing" deserving support. This makes the national symbolism of the train all the stronger. Not only is it a part of our history, but as an institution, it still deserves support from the public purse. Likewise with the "if only" myth, the belief is reinforced that if it were only possible to measure and charge the true social and individual costs of such modes as the car, passenger rail would thrive, perhaps even without subsidy!

There are lesser social-benefits myths as well. An element of train travel is the sense of community it brings. Neither the automobile, with its privacy, nor the airplane, where people largely stay in their seats, gives the sense of interaction that the train provides. "You meet such friendly people," recounted a New York couple in Jasper recently. "We almost hated to get off the train to come here [Jasper Park Lodge]."[331] This sense of interaction and community appeals, at least in theory, to a good many Canadians, even when they do not take the train with any regularity.

Finally, there is what might be termed an "if . . . then" myth, which reflects a fear of what the decline in train service means to the community involved. It is not that the loss of a passenger train or so would actually seriously undermine the community but that the loss of passenger service is taken as part of a wider economic decline. For this reason it is the smaller cities, often in the Maritimes, that fight the hardest to retain a service. Their people do not use the service more than anyone else, but the jobs the railway provides, even if relatively few, and the symbolism involved in shutting yet another link between this community and "mainstream Canada" make railway closures an emotional issue. This theme applies equally to air services. Adequate train and air services to major points symbolize a city's status, are seen as essential to encourage growth, and are a part of the employment base of the community. It is the one area, therefore, where there may be a direct trade-off between trains and planes. Better plane service could be exchanged for reduced train service.[332]

It is beyond the scope of this paper to unravel or test the many complex beliefs contained within these three major myths. Indeed, many of them are untestable, and many others, such as the national symbolism of the railway, do not lend themselves to specific cost judgements. The point is that they exist. Some may be accurate, some not. They reflect a strongly consistent part of Canadian public psychology, however, and may explain why a transportation system such as rail passenger service, so long underfunded and underutilized, has refused to die. It may also indicate that any blend of transportation systems developed for the future will have to take into account what the public expects of its national transportation system in psychological and social as well as economic terms. Certainly that has been the case through the history of the nation. Emotion and myth were important in William Hamilton Merritt's dreams of canals, Thomas Keefer's philosophizing on railroads, the nation-building imagery of CPR, C. D. Howe's aspirations for a national airline, and the Canadian fascination with the car. Everything indicates that emotion and myth will continue to be important in the future.

## ENDNOTES

1. Edith Dyell, *Canada: The New Nation* (Toronto: W. Gage, no date), pp. 390–91. This was a standard textbook for Grade 7 in Ontario schools for many years in the 1950s and early 1960s.

2. A great deal has also been written about the role of geography. For a brief example see Cole Harris, "The Myth of the Land in Canadian Nationalism," in *Nationalism in Canada*, edited by Peter Russell (Toronto: McGraw-Hill Ryerson, 1966), pp. 27–46.

3. D. A. MacGibbon, *Railway Rates and the Canadian Railway Commission* (Boston: Houghton Mifflin Co., 1917), p. 54.

4. The best overview of the freight-rate controversy in Canadian history is Howard Darling, *The Politics of Freight Rates: The Railway Freight Rate Issue in Canada* (Toronto: McClelland and Stewart, 1980).

5. Edwin C. Guillet, *The Story of Canadian Roads* (Toronto: University of Toronto Press, 1966), p. 14.

6. W. J. Eccles, *The Canadian Frontier, 1534–1760* (New York: Holt Rinehart and Winston, 1969), pp. 4–5.

7. For an overview of the French regime see G. P. de T. Glazebrook, *A History of Transportation in Canada*, Vol. 1 (Toronto: McClelland and Stewart, 1964), Chap. 1.

8. Ibid., Vol. 1, p. 68.

9. See Glazebrook, *A History of Transportation in Canada*, Vol. 1; Donald Creighton, *The Commercial Empire of the St. Lawrence* (Toronto: Macmillan, 1956); Doug Owram, *Building for Canadians: A History of the Department of Public Works 1840–1960* (Ottawa: Public Works Canada, 1979).

10. Glazebrook, *A History of Transportation in Canada*, Vol. 1.

11. As Konrad Studnicki-Gizbert has pointed out, Canada was, in modern terminology, a developing country in terms of transportation until the 20th century. It had no infrastructure, and yet an infrastructure was crucial to further development. Accordingly, it had to expend a large portion of available funds on construction. See Konrad Studnicki-Gizbert, "Transportation," in *The Canadians 1867–1967*, edited by R. C. Brown and J. M. S. Careless (Toronto: Macmillan, 1967), pp. 502–24.

12. H. G. Aitken, *The Welland Canal Company: A Study in Canadian Enterprise* (Cambridge: Harvard University Press, 1954), p. 86.

13. As an example see Peter Baskerville, "Entrepreneurship and the Family Compact; York-Toronto, 1822–1855," *Urban History Review*, 9 (1981), pp. 15–34. See also Owram, *Building for Canadians*, chaps. 2–3. As Creighton has shown, the situation in Lower Canada before the rebellion was more complex, with divisions along linguistic lines often impeding development. By the time of the canal-building era in the 1840s, however, a coalition of commercially minded politicians, both francophone and anglophone, had accepted the basic need for development.

14. This notion of a head-on battle with the United States for trade supremacy is best described in Creighton's classic study, *The Commercial Empire of the St. Lawrence*. See also Gilbert Tucker, *The Canadian Commercial Revolution 1845–1851* (New Haven: Yale University Press, 1936).

15. National Archives of Canada (NAC), Records of State for Upper Canada (RG 1E3), Vol. 60A, Council Chambers, January 8, 1799.

16. The protest was contained in Robert Gourlay's 1819 grievances against the Upper Canadian government. See Gerald Craig, *Upper Canada, The Formative Years 1784–1841* (Toronto: McClelland and Stewart, 1963), p. 94.

17. Speech of R. B. Sullivan, cited in *British Colonist*, September 1, 1841.

18. See A. W. Campbell, *Road Bulletin* No. 2 (Ontario Department of Agriculture, 1896) for a strong condemnation of the statutory system.

19. Glazebrook, *A History of Transportation in Canada*, Vol. 1. Chap. 4 has a short history of roads in New France and early Upper Canada. See also Guillet, *The Story of Canadian Roads*, Chap. 1.

20. Guillet, *The Story of Canadian Roads*, pp. 65–66.

21. Glazebrook, *A History of Transportation in Canada*, Vol. 1, p. 101.

22. Ibid., p. 134.

23. Ibid., p. 137.

24. Walter Houghton, *The Victorian Frame of Mind* (New Haven: Yale University Press, 1957); Asa Briggs, *Iron Bridge to Crystal Palace: Impact and Images of the Industrial Revolution* (London: Thames and Hudson, 1979).

25. Thomas Keefer, *The Philosophy of Railroads* with an Introduction by H. V. Nelles (Toronto: University of Toronto Press, 1972), p. 3. Original published in 1849.

26. Ibid., p. 10.

27. See, as early examples, Millington Henry Synge, *Canada in 1848* (London, 1848) and F. A. Wilson and A. B. Richards, *Britain Redeemed and Canada Preserved* (London, 1850). For an American counterpart see Asa Whitney, *A Project for a Railroad to the Pacific* (New York, 1852).

28. On the railways' impact on industry see Paul Craven and Tom Traves, "Canadian Railways as Manufacturers, 1850–1880," in *Perspectives on Canadian Economic History*, edited by Douglas McCalla (Toronto: Copp Clark Pitman, 1987), pp. 118–43.

29. Kenneth Norrie and Douglas Owram, *A History of the Canadian Economy* (Toronto: Harcourt Brace Jovanovich, 1991), pp. 225–27.

30. Glazebrook, *A History of Transportation in Canada*, Vol. 1, Chap. 5; G. R. Stevens, *History of the Canadian National Railways* (New York: Macmillan, 1973); J. M. S. Careless, *The Union of the Canadas: The Growth of Canadian Institutions 1841–1857* (Toronto: McClelland and Stewart, 1967).

31. *Statutes of the Province of Canada*, 12 Vict. c. 29.

32. Ibid., 14 & 15 Vict. c. 51.

33. W. L. Morton, *The Critical Years: The Union of British North America 1857–1873.*

34. G. R. Stevens, *Canadian National Railways*, Vol. 1 (Toronto: Clark Irwin, 1960), pp. 172–85.

35. Robin Winks, *Canada and the United States; The Civil War Years* (Montreal: Harvest House, 1971), Chap. 6.

36. *Statutes of Canada*, 31 Vict. (1867–1868), c. 13, *An Act respecting the construction of "The Intercolonial Railway"*; British Columbia Terms of Union, 1871; s. 11: Prince Edward Island Terms of Union, 1873.

37. Cited in Owram, *Building for Canadians*, p. 96.

38. See Sir Sandford Fleming, *The Intercolonial* (Ottawa: Queen's Printer, 1877).

39. Ernest R. Forbes, *The Maritime Rights Movement, 1919–1927: A Study in Canadian Regionalism* (Montreal: McGill-Queen's University Press, 1979), pp. 22–23, 25–27.

40. Silver Donald Cameron, "The Iron Road to Yesterday and Tomorrow," cited in Jo Davis, *Not a Sentimental Journey: What's behind the VIA Rail cuts and What YOU can do about it* (Gunbyfield Publishing, 1990), p. 18.

41. Peter George, "Rates of Return in Railway Investment and Implications for Government Subsidization of the Canadian Pacific Railway," *Canadian Journal of Economics* 1 (1968): pp. 740–62; and his "Rates of Return of Government Subsidization of the Canadian Pacific Railway: Some Further Remarks," *Canadian Journal of Economics* 8 (1975): pp. 591–600. For a criticism of George see Lloyd J. Mercer, "Rates of Return and Government Subsidization: An Alternate View, *Canadian Journal of Economics* 6 (1973): pp. 428–37.

42. *Canadian Pacific Facts and Figures* (Canadian Pacific Foundation Library, 1946), p. 71.

43. See, as one of hundreds of examples, *Toronto Globe*, December 13, 1880.

44. *The Economist*, 39 (February 19, 1881), p. 219.

45. Advertisement in *Maclean's Magazine*, April 15, 1949, p. 5.

46. See as examples J. C. James and Alan MacDougal, *The Western Division of the Canadian Pacific Railway* (London: Institute of Civil Engineers, 1884); Harry Jones, *Railway Notes in the Northwest* (no publisher, 1884); J. H. Secretan, *Canada's Great Highway: From the First Stake to the Last Spike* (London: John Lane, The Bodley Head Ltd., 1924); Sir Sandford Fleming, *Report on Surveys and Preliminary Operations on the Canadian Pacific Railway up to January 1877* (Ottawa: McLean Roger, 1877).

47. J. P. Sheldon, *To Canada and through It with the British Association* (Ottawa, 1885).

48. R. G. MacBeth, *The Romance of the Canadian Pacific Railway* (Toronto: The Ryerson Press, 1924), p. 46.

49. Cited in John Murray Gibbon, *Steel of Empire: The Romantic History of the Canadian Pacific , the Northwest Passage of Today* (New York: Bobbs-Merrill, 1935), p. 296.

50. Historic plaque at the site of the last spike. Cited in Progressive Conservative Party, "The Last Straw: Report of the Task Force on Rail Passenger Service," 1981, p. 1.

51. Allen Smith, "The Myth of the Self-made Man in English Canada 1850–1914," *Canadian Historical Review* 59, 2 (June 1978), p. 189.

52. Gibbon, *Steel of Empire*, p. 313.

53. Walter Vaughan, *The Life and Work of Sir William Van Horne* (New York: The Century Co., 1920), p. 34.

54. Heather Gilbert, *Awakening Continent: The Life of Lord Mount Stephen, Vol. 1: 1829–91* (Aberdeen: Aberdeen University Press, 1965); D. Cruise and A. Griffiths, *Lords of the Line* (Markham: Viking, 1988); Pierre Berton, *The Last Spike: The Great Railway 1881–1885* (Toronto: McClelland and Stewart, 1971).

55. Cruise and Griffiths, *Lords of the Line*, p. xvii.

56. *Canadian Pacific Facts and Figures*, p. 10.

57. Goldwin Smith, *Canada and the Canadian Question*, with an introduction by Carl Berger (Toronto: University of Toronto Press, 1971), p. 4. Original published in 1891.

58. O. D. Skelton, "General Economic History 1867–1912," in *Canada and Its Provinces*, Vol. 9, edited by Adam Shortt and Arthur Doughty (Toronto: Glasgow Brook and Co., 1914), pp. 95–276. O. D. Skelton, *The Railway Builders: A Chronicle of Overland Highways* (Toronto, 1916).

59. Canada, *Report of the Royal Commission on Dominion-Provincial Relations* (Ottawa: King's Printer, 1940). Perhaps even more influential than the report itself were some of the studies undertaken for the Commission. See, for example, W. A. Mackintosh, *The Economic Background of Dominion-Provincial Relations* (Ottawa: King's Printer, 1939).

60. W. A. Mackintosh, "Economic Factors in Canadian History," *Canadian Historical Review* IV, 1 (1923).

61. Carl Berger, *The Writing of Canadian History: Aspects of English-Canadian Historical Writing since 1900*, second edition (Toronto: University of Toronto Press, 1986), p. 97. See also Harold A. Innis, "Transportation as a Factor in Canadian Economic History," in *Essays in Canadian Economic History*, edited by Mary Q. Innis (Toronto: University of Toronto Press, 1956), pp. 62–77.

62. See Barry G. Ferguson, "The New Political Economy and Canadian Liberal Democratic Thought: Queen's University 1890–1925" (PhD thesis, York University, 1982), p. 124 ff.

63. On nationalism and historical interpretation see Ramsay Cook, "La Survivance English-Canadian Style," in his *The Maple Leaf Forever*, 2nd edition (Toronto: The MacMillan Company of Canada Limited, 1977).

64. Berger, *The Writing of Canadian History*, pp. 241–42.

65. Creighton, *The Commercial Empire of the St. Lawrence.*

66. Donald Creighton, *John A. Macdonald: Vol. 2: The Old Chieftan* (Toronto: Macmillan, 1955).

67. Pierre Berton, *The National Dream: The Great Railway 1871–1881* (Toronto: McClelland and Stewart Limited, 1970), p. 7.

68. "Towards the Last Spike," lines 222–23 in *E. J. Pratt: Complete Poems*, edited by Sandra Dwja and R. G. Moyles (Toronto: University of Toronto Press, 1989), pp. 124–25.

69. John Murray Gibbon, *Steel of Empire.*

70. Ernest R. Forbes, *The Maritime Rights Movement*, p. 27.

71. Ontario, *Royal Commission on Transportation, 1938* (Toronto: King's Printer, 1939), p. 52.

72. Good Roads Association of the Province of Ontario, *Annual Report, Vol. II. 1894* (Toronto, 1895), p. 15.

73. See comments of Andrew Pattullo, on "Road-Making," in *Report of the Good Roads Association of the Province of Ontario* (Toronto: Warwick Bros., 1895), pp. 9–10.

74. On the Dawson route see *Annual Reports of the Department of Public Works, 1868–1873* and Owram, *Building for Canadians*, pp. 107–10. On the Yale Road see Guillet, *The Story of Canadian Roads*, pp. 91–101.

75. Morris Zaslow, *The Opening of the Canadian North 1870–1914* (Toronto: McClelland and Stewart Limited, 1971), p. 106.

76. O. D. Skelton, *General Economic History of the Dominion 1867–1912* (Toronto: Publishers' Association of Canada, 1913).

77. S. J. McLean, "National Highways Overland," in *Canada and Its Provinces*, Vol. 10, edited by Adam Shortt and Arthur Doughty, pp. 359–472.

78. G. P. de T. Glazebrook, *A History of Transportation in Canada*, Vol. II (Toronto: McClelland and Stewart Limited, 1964).

79. See *Provincial Statutes of Canada*, 14 & 15 Vict, c. 51.

80. Some of the best travelogues include J. Ewing Ritchie, *To Canada With Emigrants* (London, 1885); Douglas Sladen, *On the Cars and Off: Being a Journal of the Pilgrimage along the Queen's Highway to the East, from Halifax Nova Scotia to Victoria in Vancouver's Island* (London, 1895); B. Pullen-Burry, *From Halifax to Vancouver* (London, 1912). On British travellers in Canada generally during these years see R. G. Moyles and Doug Owram, *Imperial Dreams and Colonial Realities: British Views of Canada 1880–1914* (Toronto: University of Toronto Press, 1988).

81. See, for example, Canadian Pacific Railway (CPR), *Fishing resorts along the Canadian Pacific Railway, eastern division: where to go for trout, bass and maskinonge, and what it costs to get there* (Montreal, 1887); CPR, *Mississauga: a wonderfully interesting two hundred and seventy-five mile canoe trip through the Mississauga Forest reserve* (Montreal, 1921).

82. Figures from W. Kaye Lamb, *History of the Canadian Pacific Railway* (Toronto: Macmillan Publishing Co., Inc., 1977), Appendix, pp. 446–47.

83. For the most comprehensive study of Canadian Northern see Ted Regehr, *The Canadian Northern Railway: Pioneer Road of the Northern Prairies 1895–1918* (Toronto: Macmillan Publishing Co., Inc., 1976).

84. R. C. Brown and G. R. Cook, *Canada 1896–1921: A Nation Transformed* (Toronto: McClelland and Stewart, 1974), pp. 148–53, 200–203; John Eagle, "Sir Robert Borden and the Railway Problem in Canada Politics, 1911–1920" (PhD thesis, University of Toronto, 1972.)

85. Michael Bliss, *Northern Enterprise: Five Centuries of Canadian Business* (Toronto: McClelland and Stewart, 1987), p. 328.

86. T. D. Regehr, "The Canadian Northern Railway: The West's Own Product," *Canadian Historical Review* 50, 2 (June 1970).

87. Frederick A. Talbot, *The Making of a Great Canadian Railway* (Toronto: The Musson Book Company Limited, 1912), pp. 18, 26, 71.

88. Brown and Cook, *Canada 1896–1921*, pp. 200–203.

89. Canada, *Report of the Royal Commission to Inquire into Railways and Transportation in Canada* (Ottawa: King's Printer, 1917).

90. Stevens, *History of the Canadian National Railways*, p. 277.

91. Statistics Canada, *Historical Statistics of Canada*, second edition, F.H. Leacy (ed.), 1983, Series H448–H457.

92. The actual bill creating the CNR was passed in 1919. *Statutes of Canada*, 9–10 Geo. V, c. 13.

93. Glazebrook, *A History of Transportation in Canada*, Vol. II, p. 176.

94. There is a series of timetables available in what is known as the Peel collection of the University of Alberta library. This material on routes and services draws heavily upon these as well as upon more general railway histories. Also, those books designed for the railway buff provide exceptional detail on the interior of coaches, facilities available, etc.

95. Lamb, *History of Canadian Pacific*, p. 268.

96. Canadian Pacific Timetable, 1897. Stopover for Field House.

97. Lamb, *History of Canadian Pacific*, chaps. 17, 23.

98. Number of train trips derived from *Canada Year Book*, 1919–1929.

99. Immigration in the 1930s would effectively disappear, going to as low as 5 percent of the pre-World War I figures. See Statistics Canada, *Historical Statistics of Canada*, Series A350.

100. The basic background on the 19th century tourist efforts of the Canadian Pacific is drawn from E. J. Hart, "See This World Before the Next: Tourism and the CPR," in *The CPR West*, edited by Hugh A. Dempsey (Vancouver: Douglas and McIntyre, 1984), pp. 151–69.

101. Mount Stephen House at Field, Glacier House at Glacier, Fraser Canyon House at North Bend.

102. The initial chalets at Lake Louise were very small. It was not until after the turn of the century that there was significant hotel accommodation on the shores of the lake.

103. Lamb, *History of Canadian Pacific Railway*, p. 268.

104. John Herd Thompson with Allen Seager, *Canada 1922–1939: Decades of Discord* (Toronto: McClelland and Stewart, 1985), p. 94.

105. On the railway hotels generally, see Howard Kalman, *The Railway Hotels and the Development of the Chateau Style in Canada* (Victoria: University of Victoria, 1968).

106. CPR, *Your Journey through the Canadian Rockies between Calgary and Vancouver* (1928).

107. Canadian National Railway System (CNR), *Annual Report for 1925*, p. 8.

108. CNR, *Annual Report for 1965*.

109. CPR, *Your Journey*.

110. *Canada Year Book*, 1930, p. 620.

111. *Roads and Transportation Association of Canada 1914–1974* (Ottawa: RTAC, 1974), p. 2.

112. James J. Flink, *The Car Culture* (Cambridge: MIT Press, 1975), p. 26–27.

113. *Statutes of Ontario*, 3 Edw. VII (1903), c. 27. Quebec introduced legislation in 1906. See *Statutes of Quebec*, 6 Edw. VII (1906), c. 13.

114. *Statutes of Prince Edward Island*, 3 Geo. V (1913), c. 7.

115. Flink, *The Car Culture*, p. 29 gives the average automobile price. The salary estimate comes from Statistics Canada, *Historical Statistics of Canada*, Tables E41–E48.

116. John B. Rae, *American Automobile Manufacturers: The First Forty Years* (Philadelphia: Chilton Press, 1959) discusses the growth of the auto industry in some detail.

117. Statistics Canada, *Canada Year Book*, 1933, p. 686.

118. "Address" of the Mayor of Hamilton, Canadian Good Roads Association (CGRA), *Proceedings* (1918), p. 5.

119. Flink, *The Car Culture*, p. 2.

120. Statistics Canada, *Canada Year Book*, 1933, p. 244.

121. Norrie and Owram, *A History of the Canadian Economy*, Chap. 17.

122. Flink, *The Car Culture*, p. 35.

123. Tad Burness, *Cars of the Early Twenties* (New York: Chilton Book Company, 1968), p. 77.

124. W. H. Dandurand, "Address," CGRA, *Proceedings* (1915), p. 16.

125. Flink, *The Car Culture*, p. 39.

126. R. A. Falconer, "Address," CGRA, *Proceedings* (1915), p. 35.

127. *Canadian Motorist*, April 1929, p. 163; August 1928, p. 296; Burness, *Cars of Early Twenties*, p. 160.

128. Burness, *Cars of Early Twenties*, p. 194.

129. This commentary rests on advertisements in John D. Bondt, *Canada on Wheels* (Oberon Press, 1970); Burness, *Cars of Early Twenties*; the Ontario Motor League Publication, *Canadian Motorist* 1926–1930. For a somewhat different view see Charles Sanford, "Woman's Place in American Car Culture," in *The Automobile and American Culture*, edited by David Lewis and Laurence Goldstein (Ann Arbor: The University of Michigan Press, 1981), pp. 137–52.

130. As examples see the following articles from the *Canadian Motorist*: Bonnycastle Dale, "Sights of The Knights of The Road," June 1928, pp. 205–07; Clara Dennis, "Into the North of Cape Breton by Motor," June 1929, pp. 125–27+.

131. *Canadian Motorist* (May 1929), p. 217.

132. Mariana Valverde, *The Age of Light, Soap, and Water* (Toronto: McClelland and Stewart, 1991) gives an overview of some of the reformism of the age.

133. *Report of the Good Roads Association* (Toronto: Ontario Department of Agriculture, 1894), p. 5.

134. *Statutes of Canada 1917*, 7-8 Geo. V, c. 74. Roads and Transportation Association of Canada, *Roads and Transportation Association of Canada, 1914–1974*.

135. CGRA, *Proceedings* (1915).

136. On the 1920 meetings see CGRA, *Proceedings* (1920). For a sense of the public attention and for the details of the 1925 national meeting see the Transportation Association of Canada, *The Canadian Good Roads Association Scrapbook*, for 1925.

137. Tony Cashman, *The Alberta Motor Association: A History*, p. 1.

138. Canadian Automobile Association Headquarters, Ottawa, Binder entitled "Historical Documents, 1916–1967, Section 1916" (henceforth termed CAA Binders).

139. William Findlay, "Value of the Local Association in a Nation-Wide Highway Movement," CGRA, *Proceedings* (1920), pp. 43–46.

140. On the international background of the Motor Club concept see Margaret Anderson "Outline of the History and Background of the World-Wide Automobile Association," CAA Binders, File 1961.

141. *Statutes of the Province of Ontario*, 1901, 1 Edw. VII, c. 32; *Statutes of Quebec 1907*, 7 Edw. VII, c. 3; 1912, 2 Geo.. V, c. 17, 21, 22, 23.

142. Thomas Church, "Address," CGRA *Proceedings* (1915), p. 12.

143. *Statutes of Canada*, 9-10 Geo. V (1919), c. 54. "The Canada Highways Act."

144. Ontario, *Report of the Royal Commission on Transportation*, 1938, p. 85.

145. Flink, *The Car Culture*, p. 149.

146. Alberta was followed by Manitoba in 1923; Prince Edward Island in 1924; Ontario, Quebec and British Columbia in 1925; Nova Scotia and New Brunswick in 1926; and Saskatchewan in 1929. Source: Ontario, *Report of the Royal Commission on Transportation*, p. 92.

147. Transport Association of Canada Library, "Canadian Good Roads Association, Scrapbooks, 1925."

148. Gordon Donald Campbell, "An Analysis of Highway Finance and Road User Imposts in Canada" (PhD thesis, Purdue University, 1956), pp. 97–99.

149. For a discussion of this relationship see Nancy Bryan, *More Taxes and More Traffic* (Toronto: Canadian Tax Foundation, 1972), p. 4; Saskatchewan, *Report of the Royal Commission on Taxation* (Regina: Queen's Printer, 1965), p. 34; Ontario Department of Highways, *A Plan for Ontario's Highways* (December 1956), p. 20.

150. *Statutes of Canada*, 9-10 Geo. V (1919), 13-14 Geo. V (1923), c. 4; 15-16 Geo. V (1925), c. 4.

151. Guillet, *The Story of Canadian Roads*, p. 163.

152. Previously, cars on Vancouver Island had to drive on the left side of the road; those on the mainland, on the right.

153. N. Vermilyen, President's Address, "Proceedings of the Twelfth Annual Meeting of the Ontario Good Roads Association," 10 in *Ontario Sessional Papers* XLVI (1914).

154. G. W. Tillson, "Wearing Surfaces," CGRA, *Proceedings* (1915), pp. 27–33.

155. Alberta, *Annual Report of the Department of Public Works, 1922*, p. 7; *1923*, p. 8.

156. F. C. Biggs, *Report of the Accomplishments of the Highway Department of the Province of Ontario covering the Years 1920, 1921 and 1922* (Toronto: Government of Ontario, 1923), p. 3.

157. British Columbia, *Report of the Minister of Public Works, for the Fiscal Year 1928–29*, p. 6.

158. Alberta, *Annual Report of the Department of Public Works, 1928-29*, p. 15.

159. This material is drawn from the annual reports of the various provinces for the 1920s. On the specific Ontario mileage see Ontario, *Annual Report of the Department of Public Highways, 1926*.

160. Ontario, *Annual Report of the Department of Public Highways, 1927*, p. 74; British Columbia, *Report of the Minister of Public Works, 1928–29*, p. T78.

161. D. G. Wetherall and I. Kmet, *Useful Pleasures: The Shaping of Leisure in Alberta 1896–1945* (Edmonton: Alberta Department of Culture and Multiculturalism, 1990), p. 16.

162. See Ontario, *Report of the Royal Commission on Transportation*, 1938, Table A10.4 for a sense of relative rail-bus costs in the 1930s.

163. Alberta, *Annual Report of the Department of Public Works*, 1926–1930.

164. *Ottawa Journal*, April 18, 1925.

165. CNR *Annual Report for 1931*, p. 7.

166. Stevens, *History of Canadian National Railways*, p. 370.

167. Ian Drummond, *Progress without Planning: The Economic History of Ontario from Confederation to the Second World War* (Toronto: University of Toronto Press, 1987), p. 270.

168. Statistics Canada, *Canada Year Book*, 1933, p. 856.

169. Alberta, *Annual Report of the Department of Public Works, 1933–34*, p. 7; Ontario, *Annual Report of the Department of Public Highways, 1933*, p. 9.

170. Lamb, *History of the Canadian Pacific Railway*, p. 333.

171. On CNR in the 1920s see Stevens, *History of the Canadian National Railways*, chaps. 19 and 20.

172. These and other CNR numbers during the Great Depression are from CNR, *Annual Report*, 1929–1939.

173. Canada, *Report of the Royal Commission on Railways and Transportation in Canada, 1931–32* (Duff Commission) (Ottawa: King's Printer, 1932), p. 43.

174. CNR, *Annual Report for 1932*, p. 4.

175. These CPR numbers are derived from CPR, *Annual Report*, 1929–1939.

176. A. W. Currie notes that in the 1930s the annual CNR deficit was approximately equivalent to the entire revenue generated by Dominion income tax. A. W. Currie, *Canadian Transportation Economics* (Toronto: University of Toronto Press, 1967), p. 10.

177. Canada, House of Commons, *Debates*, February 7, 1933, pp. 1867–68.

178. *Statutes of Canada*, 23-24 Geo. V, c. 23, s. 3.

179. CNR, *Annual Report for 1934*, p. 3.

180. CNR, *Annual Report for 1939*, p. 4.

181. These figures derived from Statistics Canada, *Canada Year Book*, 1939–1946, and annual reports of the railways, 1939–1945.

182. Statistics Canada, *Historical Statistics of Canada*, Series T147–T162.

183. Canada, Privy Council Office, *Canadian War Orders and Regulations, 1942* (Ottawa: King's Printer, 1942); Department of Munitions and Supply, *Transit Controller*, October 31, 1942, Transit Order 3-B.

184. Canada, *Report of the Royal Commission on Transportation*, Vol. I (Ottawa: Queen's Printer, 1961), p. 46.

185. Canada, *Final Report of the Royal Commission on Canada's Economic Prospects* (Ottawa: Queen's Printer, 1957).

186. For an analysis of subsidy patterns see K. Studnicki-Gizbert, draft manuscript on Transportation Policy in Canada, Chap. 2, p. 4.

187. Currie, *Canadian Transportation Economics*, p. 15.

188. Campbell, "An Analysis of Highway Finance and Road User Imposts in Canada," p. 59.

189. Derived from Bryan, *More Taxes and More Traffic*, Table A-16. See also Michel Bérard, *Les Routes du Québec* (Quebec: Minister of Roads, 1964), p. 63.

190. There is a great deal of literature on this, especially in the United States. See, for a quick overview, William L. O'Neill, *American High: The Years of Confidence 1945–1960* (New York: The Free Press, 1986). Note especially his comments on "Automania," pp. 29–32.

191. Thomas Hine, *Populuxe* (New York: Alfred A. Knopf, 1986).

192. *Maclean's*, December 1, 1946, pp. 42–43.

193. *Newsweek*, August 4, 1952, pp. 32–33.

194. *Maclean's*, July 29, 1961, p. 3. See also, Elizabeth Macfarlan, "The Attachment to the Automobile: With Reference to Non-economic Factors Underlying this Attachment," a working paper prepared for the Royal Commission on National Passenger Transportation, November 14, 1990.

195. Toronto *Telegram*, May 3, 1954, p. 6.

196. Ontario Department of Highways, *A Plan for Ontario Highways*, p. 7.

197. Province of Quebec, *Annual Report of the Roads Department for 1946–47*, p. 11.

198. CGRA, *Proceedings* (1954), p. 8.

199. Hine, *Populuxe*, p. 56; to be fair, the combination family room-garage never really caught on. Even in an age relatively unconcerned with pollution, the combination of carbon monoxide and family living seemed to strain the love affair with the car.

200. "Report of the President," CGRA, *Proceedings of the Thirty-Fourth Convention of the Canadian Good Roads Association* (Victoria: CGRA, 1953), p. 6.

201. Bryan, *More Taxes and More Traffic*, Table 2; Statistics Canada, *Historical Statistics*, Series H197–H208 and H317–H331.

202. Perhaps the best single source for the road operations of the various provinces is in the "Roads Roundup" published each year as a part of the CGRA *Proceedings.*

203. Ontario Department of Highways, *A Plan for Ontario Highways,* p. 13.

204. *Road and Wheel,* Vol. XV, No. 1 (February 1966), p. 1.

205. See "Roads Roundup" of the CGRA, *Proceedings* (1960, 1961, 1962, 1963).

206. Province of Quebec, Minister of Highways, *Annual Report,* 1946–1947, pp. 11–13. See also Bérard, *Les Routes du Québec,* p. 49.

207. Statistics Canada, *Canada Year Book,* 1949, 1957.

208. Province of Quebec, *Annual Report,* 1959, p. 7.

209. Province of Quebec, *Annuaire statistique,* 1958, pp. 473–75.

210. J. H. Perry, "The Taxpayer's Viewpoint," CGRA, *Proceedings* (1953), p. 115.

211. Wilfred Sanders, "Assessing Public Opinion Concerning Highway Policy," CGRA *Proceedings* (1954), p. 79; Gordon Taylor, "Annual Review of the President," CGRA, *Proceedings* (1955), pp. 9–15.

212. See generally the "Roads Roundup" of the CGRA, *Proceedings* (1950–1956) and the annual reports of the departments responsible for highways in various provinces for the same years.

213. See the Symposium, "Who Shall Pay for the Roads We Need?" CGRA, *Proceedings* (1953), pp. 84–98 for comments on issue generally. For the Morrison citation see p. 96.

214. Canadian Automobile Association Library, "Brief Concerning Canadian Highways Presented to the Honourable R. H. Winters," 1955, p. 4.

215. On federal fiscal policy in these years see Robert Campbell, *The Politics of The Keynesian Experience in Canada, 1945–75* (Peterborough: Broadview Press Ltd., 1987). The post-war budget figures are on p. 228, Table VII.

216. Canada, *Dominion and Provincial Submissions and Plenary Conference Discussions,* August 6, 1945, p. 81.

217. Canada, House of Commons, *Debates,* November 21, 1949, pp. 2023–24.

218. Ibid., pp. 2027–28.

219. National Archives of Canada (NAC), Records of the Department of Public Works (DPW), Accession 84-85/61, Vol. 1206, File 90-0-1, Part 3, "Address by Robert Winters, November 1951."

220. *Statutes of Canada,* 1949, 13 Geo. VI, c. 40. The road was to be constructed as a two-lane paved highway, 24 feet wide, with 10-foot shoulders and maximum grades of 6 percent. For a brief summary of the fiscal arrangements concerning the Trans-Canada see Bryan, *More Taxes and More Traffic,* pp. 135–42.

221. "Roads Roundup — Quebec," CGRA, *Proceedings* (1954), p. 64.

222. DPW, *Annual Report of Proceedings under the Trans-Canada Highway Act*, 1954, p. 1.

223. NAC, Records of DPW, Accession 84/85/61, Vol. 1206, File 90-0-1, Part 4, Robert Winters to J. T. Douglas, October 21, 1955.

224. DPW, *Annual Report Proceedings under the Trans-Canada Highway Act*, 1958–1962 gives a summary of the various amendments and details of progress.

225. Ibid., 1962, p. 3.

226. For a brief history of the Roads to Resources Program see Guillet, *The Story of Canadian Roads*, Chap. 13.

227. Robert Bothwell, Ian Drummond and John English, "Canada since 1945," in *Power, Politics and Provincialism*, revised edition (Toronto: University of Toronto Press, 1989), pp. 187–88. For a good example of the lack of such concerns see Guillet's comments on the flexibility of roads. They, he said, could be built and abandoned "without loss, having paid for themselves many times over," *The Story of Canadian Roads*, p. 189.

228. Bryan, *More Taxes and More Traffic*, p. 139, Table 29.

229. Canadian Institute of Public Opinion, Gallup poll, September 5, 1962; *Gallup Report*, November 27, 1976.

230. Robert Bothwell and William Kilbourn, *C. D. Howe: A Biography* (Toronto: McClelland and Stewart, 1979), pp. 108–109. See also Studnicki-Gizbert, draft manuscript, pp. 285–94.

231. Trans-Canada Air Lines (TCA), *Annual Report for 1945*, pp. 5–7.

232. Gordon R. McGregor, *The Adolescence of an Airline* (Montreal, 1970), pp. 8–9.

233. TCA, *Annual Report for 1947*, p. 9.

234. For very brief summary of developments in TCA see C. A. Ashley, *The First Twenty-Five Years: A Study of Trans-Canada Airlines* (Toronto: Macmillan Co. of Canada, 1963).

235. Canada, Department of Transport, *Canada in the Jet Age: A Report on a Study of Department of Transport Air Services Needs 1962–1972* (Ottawa: Department of Transport Air Services, 1962), p. 25.

236. TCA, *Annual Report*, 1945–1954.

237. It is difficult to make direct comparisons, given the different types of services involved. TCA measurements indicate, roughly, that air travel cost twice as much per passenger-mile as rail travel in 1955.

238. TCA, *Annual Report 1954*, p. 9.

239. TCA, *Annual Report 1961*, p. 7.

240. There are no detailed studies of the imagery or selling techniques of the airlines. These comments are drawn from *Maclean's* and *Chatelaine* from 1945 through 1961, as well as from more limited checks of the newspapers of the period. As John Helliwell commented to me, however, the imagery of the airplane in the North is quite different. There it was much more of a lifeline to the outside world. Equally, the mythology surrounding the Northern bush pilot takes on some of the romance associated with pioneering adventures. See John Condit, *Wings Over the West: Russ Baker and the Rise of Pacific Western Airlines* (Vancouver: Harbour Publications, 1984); Tony Foster, *The Bush Pilots: A Pictorial History of a Canadian Phenomenon* (Toronto: McClelland and Stewart, 1990).

241. TCA, *Annual Report 1961*, p. 9.

242. Studnicki-Gizbert, draft manuscript, Part II, p. 100.

243. Stevens, *History of the Canadian National Railways*, pp. 437–38.

244. For a detailed study of the freight-rate issue — one quite critical of the way it has evolved — see Howard Darling, *The Politics of Freight Rates: The Railway Freight Rate Issue in Canada* (Toronto: McClelland and Stewart, 1980).

245. D. J. Hall, "The Manitoba Grain Act: An Agrarian Magna Charta?" *Prairie Forum* 4, No. 1, pp. 105–20; Gerald Friesen, *The Canadian Prairies: A History* (Toronto: University of Toronto Press, 1984), chaps. 9 and 10.

246. See Canada, *Report of the Royal Commission on Maritime Claims* (Duncan Commission) (Ottawa: King's Printer, 1927).

247. Forbes, *The Maritime Rights Movement, 1919–1927*, pp. 25–27.

248. Province of Nova Scotia, *A Submission of Claim with Regard to Maritime Disabilities within Confederation* (1925), p. 53.

249. *Statutes of Canada*, 17 Geo. V, c. 44.

250. *CNR vs. CPR et al.* 39 CRC 1, 25–7. Cited in Canada, *Report of the Royal Commission on Transportation*, 1951, p. 24.

251. Currie, *Canadian Transportation Economics*, p. 298.

252. Darling, *The Politics of Freight Rates*, p. 185.

253. Canada, *Report of the Royal Commission on Transportation*, 1951, p. 35.

254. See as an example Province of Manitoba, *Manitoba's Submissions to The Royal Commission on Transportation* (Winnipeg, 1949), pp. 19–28.

255. Darling, *The Politics of Freight Rates*, Chap. 9.

256. Canada, *Report of the Royal Commission on Transportation* 1951, p. 137.

257. Currie, *Canadian Transportation Economics*, p. 15.

258. Canada, *Report of the Royal Commission on Transportation*, Vol. I (1961), p. 58.

259. Canada, Royal Commission on Transportation, *Submissions* (1961).

260. Ibid., Vol. 4, "Submission of Canadian National Railway," p. 5.

261. Canada, *Report of the Royal Commission on Transportation* 1961, Vol. I, pp. 11, 44. See also F. W. Anderson, "The Philosophy of the MacPherson Royal Commission and the National Transportation Act: A Retrospective Essay," in K. W. Studnicki-Gizbert, *Issues in Canadian Transportation Policy* (Toronto: Macmillan of Canada, 1974), pp. 47–75.

262. Canada, *Report of the Royal Commission on Transportation* (1961), Vol. I, p. 60.

263. On the background of the *National Transportation Act*, see Canada, House of Commons, *Debates*, 1966, pp. 7988–98. Also, Interview with J. W. Pickersgill, March 7, 1991.

264. *Statutes of Canada*, 14-15-16 Eliz. II, c. 69.

265. Ibid., s. 314J deals with passenger service reductions. On the whole question of the relationship between the NTA and the MacPherson Commission, see Anderson, *Philosophy of the MacPherson Royal Commission*, pp. 47–75.

266. *Statutes of Canada*, 14-15-16 Eliz. II, c. 69, s. 314J.

267. J. W. Pickersgill, who headed the CTC through part of this period, said that the Commission took a cautious approach to abandonment partly to prevent continual recourse to appeals to the Governor General in Council. Interview with J. W. Pickersgill, March 7, 1991.

268. Canada, House of Commons, *Debates*, September 2, 1966, p. 8038 and December 21, 1966, p. 11490 provide examples of accusations that railways were deliberately running passenger service into the ground. The Minister of Transport from 1964 to 1967 felt that the railways were sincerely making an effort in the passenger area. Interview with J. W. Pickersgill, March 7, 1991.

269. CNR, *Annual Report for 1965*, p. 10.

270. Note that as of 1970 commuters on the GO system were added to railway passenger statistics.

271. Norrie and Owram, *A History of the Canadian Economy*, Chap. 22.

272. Canadian Transport Commission (CTC), Research Branch, *Productivity Analysis of the Canadian Airline Industry*, working paper prepared by P. S. Dhruvarajan and R. F. Harris, pp. 67–69. Air Canada, *Annual Report* 1972–1976.

273. Ralph Nader, *Unsafe at Any Speed: The Designed-in Dangers of the American Automobile* (New York: Grossman Publishers, 1965).

274. Darryl Newbury, *Stop Spadina: Citizens Against an Expressway* (Mississauga: Commonact Press, 1989); *Vancouver's Transportation Future* (Simon Fraser University, Geography Dept., 1972).

275. Robert Bott, David Brooks and John Robinson, *Life After Oil: A Renewable Energy Policy for Canada* (Edmonton: Hurtig, 1983).

276. G. Leach, "Energy and the Car," in Meredith Thring, *Mankind and the Engineer*, Vol. 2 (Herts: Pereginuin, 1974), p. 108.

277. Energy, Mines and Resources Canada, *Energy Futures for Canadians* (Ottawa: Supply and Services, 1978), p. 97.

278. Transport Canada, *An Interim Report on Inter-City Passenger Movcment in Canada* (Ottawa: Department of Transport, 1975), p. 77.

279. See, for example, Science Council of Canada, *Canada as a Conserver Society*, Report 27, (Ottawa: Supply and Services, 1977) or *Transportation in a Resource Conscious Future: Intercity Passenger Travel in Canada*, Report 34 (Ottawa: Supply and Services Canada, 1982).

280. On the changing perspective in the United States see Robert Ackerstone, "Some Milestones of Automotive Literature," in *The Automobile and American Culture*, edited by David Lewis and Laurence Goldstein (Ann Arbor: University of Michigan, 1980), pp. 394–404.

281. Ontario, *Annual Report of the Department of Highways*, 1971, p. 1.

282. "President's Address," CGRA, *Proceedings* (1970), p. 4.

283. The DBS Series was 53-201, "Road Mileage and Street Expenditures."

284. On GO see Ontario, *Annual Report of the Department of Highways*, 1969, p. 1.

285. *Road and Wheel*, XV, 1 (February 1966), p. 1; XVI, 1 (February 1967), p. 1.

286. On 1980s see Council of Ministers Responsible for Transportation and Highway Safety, *National Highway Policy for Canada, Phase 2*, Table TA.

287. Canada, *Report of the Royal Commission on Transportation*, Vol. 1 (1961), pp. 26–28.

288. Michael Jackson, "Introduction," in *Proceedings of the First National Rail Passenger Conference*, edited by Michael Jackson (University of Regina, Department of Extension, 1977), pp. 4–5.

289. Ibid., "Address by Hon. Otto Lang," p. 16.

290. Interview with Otto Lang, Winnipeg, March 5, 1991.

291. Howard J. Darling, "An Historical Review of Direct Transport Subsidies in Canada," a report commissioned by the Canadian Transport Commission (June 1975). See also CTC Research Branch, *A Review of the Existing Intercity Passenger Transport Systems* (1975), Table 8.2, which gives a route by route breakdown of the subsidies as they were in the early 1970s.

292. Transport Canada, *An Interim Report on Inter-City Passenger Movement in Canada*, p. 115.

293. Canada, House of Commons, *Debates*, September 1, 1966, p. 7989.

294. See CTC, *Annual Report* 1970–1973 for summaries of decisions in this area. In discussing the CTC policy in these years Jack Pickersgill, as head of the CTC, believed that that body should not get ahead of public or political opinion and thereby face possible reversal of

its decisions and undermining of its credibility. Interview with J. W. Pickersgill, March 7, 1991. See also CTC, Research Branch, *An Analysis of Railway Transport Committee Decisions 1967–1980* (Ottawa: CTC, 1982).

295. Canada, House of Commons, *Debates*, January 29, 1976, pp. 10437–47.

296. For the directives to the CTC see Transport Canada, *Highlights of Rail Passenger Policy Announcement by Transport Minister Otto Lang*, January 29, 1976.

297. Canada, House of Commons, *Debates*, January 29, 1976, p. 10438. Interview with Otto Lang, March 5, 1991.

298. CTC, Railway Transport Committee, *Final Plan for Eastern Transcontinental Passenger Train Service* (June 1977); *Preferred Plan for Western Transcontinental Passenger Train Service* (April 1977). See, for press coverage, *Globe and Mail*, February 15, 1977, p. B1; April 18, 1977, p. 6; May 3, 1977, p. B1; May 28, 1977; *Winnipeg Free Press*, March 22, 1977, p. 6; May 18, 1977, p. 7.

299. Vote 52d Department of Transport *Appropriation Act* No. 1, 1977.

300. Interview with Harry Gow, President of Transport 2000, January 15, 1991.

301. For a sense of the attention, see the *Halifax Chronicle-Herald*'s reporting of the CTC, Rail Committee hearings in May 1977. *Halifax Chronicle-Herald* May 16, 1977, p. 1; "Nova Scotia notebook," May 17, 1977, p. 6; "Funds key to rail's survival," and "Service should be tied to usage — MP," May 19, 1977, p. 1; "Real study needed on transportation," May 20, 1977, p. 6.

302. VIA Rail Canada Inc., *Annual Report 1985*, p. 10.

303. For a few examples see, Science Council of Canada, *Transportation in a Resource-Conscious Future*; CTC, Research Branch; David McQueen, "Aspects of Rail Passenger Policy in Canada," memo, unpublished, 1984.

304. Science Council of Canada, *Transportation in a Resource-Conscious Future*, p. 57.

305. On the opposition to cutbacks see the testimony in Progressive Conservative Party, *The Last Straw*. On the Gallup figures see *Gallup Report*, October 24, 1981, which showed that 51 percent of Canadians disapproved of cutbacks in rail passenger service and only 27 percent approved.

306. Progressive Conservative Party, *The Last Straw*.

307. Ontario Task Force on Provincial Rail Policy, *The Future of Rail* (Toronto, 1981) pp. 43–44.

308. Statistics Canada, *Rail in Canada 1987* (Ottawa: Statistics Canada, 1989), p. 24.

309. Transport Canada, *Freedom to Move: A Framework for Transportation Reform* (July 1985), p. 1.

310. "Will there be a future for Via Rail?" *Globe and Mail*, January 19, 1989, p. A6.

311. See, as examples of public concern, *Montreal Gazette*, April 13, 1989, p. A1, "81% tell Gallup they want Ottawa to retain VIA"; April 14, 1989, p. D3, "VIA needs more help, not less"; *Globe and Mail*, p. A5, "Howls of protest over cuts in Atlantic Canada"; *Winnipeg Free Press*, October 5, 1989, p. 1, "VIA cuts greeted with tears, cheers" and p. 6 "Much pain; little gain"; *Halifax Chronicle Herald*, October 5, 1987, p. B1, "VIA cuts met with fear, anger" and "Passengers ponder life without VIA."

312. Statistics Canada, Catalogue No. 51-206 and 51-002.

313. JoAnne Bonnyman and Robert Dodd, "A Review of Low Priced Air Fares 1979" (Ottawa: CTC, Passenger and Aviation Economics, Research Branch, November 1980).

314. It is interesting that neither J. W. Pickersgill nor Otto Lang, when interviewed as part of this project, were very optimistic about the survival of the two airlines. Interviews of March 5, 1991 and March 7, 1991.

315. Roads and Transportation Association of Canada, *Roadway Infrastructure Study* (Ottawa: RTAC, 1987).

316. *Gallup Report*, October 24, 1981. It should be noted that opinion in Quebec was very close (41 percent to 40 percent).

317. *Gallup Report*, April 13, 1989; *Winnipeg Free Press*, July 10, 1989, p. 28.

318. "Polls show travel sacred to Canadians", *Winnipeg Free Press*, July 10, 1989, p. 28.

319. See, most recently, the comments of the public before the Royal Commission on National Passenger Transportation itself. Canada, Royal Commission on National Passenger Transportation, *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, 1991), pp. 133–34.

320. VIA Rail Canada Inc., *Annual Report 1985*, p. 9.

321. Transport 2000, "Submission to the Royal Commission on National Passenger Transportation," (1991) p. 4.

322. "VIA Rail: national dream fades," *Toronto Star*, March 28, 1989, p. A4.

323. Jean-Paul Desbiens, "Trains: to people and to the land, a heritage. He remembers them well," *Globe and Mail*, May 7, 1977, p. 6.

324. Canada, *Report of the Royal Commission on Transportation* (1961), p. 32.

325. Canada, Royal Commission on Transportation, *Submissions*, Vol. 30, p. 4416; Vol. 33, p. 5184.

326. For a good example of the arguments along these lines see testimony in Progressive Conservative Party, *The Last Straw*.

327. Transport 2000, "Brief to the Railway Transport Committee at Maritime Rail Passenger Hearings, April, 1977," p. 6.

328. Transport 2000, "Inter-City Railway Passenger Transportation in Central Canada over the Next Ten Years: A Public Interest Approach to Development" (September, 1979), p. 2.

329. Canada, House of Commons, Standing Committee on Transport, *Report to the House*, November 8, 1989, p. 3.

330. "Count the social costs too," *Globe and Mail*, April 18, 1977, p. A6.

331. This unscientific observation by the author came during a March visit to Jasper. The couple had travelled from Montreal to the mountains.

332. Canada, Royal Commission on Transportation, "Hearings At Fredericton," *Submissions*, Vol. 3, November 9, 1959. Both the official delegation from the city and the Chamber of Commerce looked at air travel and concentrated on adequate direct routes rather than the particular mode of travel.

## 2

# U.S. INTERCITY PASSENGER TRANSPORTATION POLICY, 1930–1991: AN INTERPRETIVE ESSAY

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## 1. INTRODUCTION

The U.S. has not had anything resembling a rational, coherent or unified policy with respect to transportation in general and even less of one regarding passenger transportation in particular. Legislative changes since the late 1970s in the direction of "greater reliance upon market forces" represent the beginning of a more coherent and consistent approach but there is no certainty that this will persist. The emphasis upon some variant of the economists' efficiency criteria may turn out to be short-lived. Certainly the "economist's hour," as it has been called,[1] took a long time coming to the area of transportation policy and despite some recent successes constantly needs to be addressed, as will be noted later. Thus the characterization of the past U.S. federal government's approach to transportation policy as "A chaotic patchwork of inconsistent and often obsolete legislation [that] has evolved from a history of specific actions addressed to specific problems of specific industries at specific times" is not an unfair appraisal, all the more telling since it came from the Special Message to the Congress on Transportation by President Kennedy in 1962.[2] As late as 1979 and despite some 20 or more years of strong pressures from the economic community, backed up more or less by every president from Kennedy on, a major policy

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study[3] could with justification still assert that the government's approach to transportation remained "an assortment of policies and programs which have been developed in an *ad hoc* fashion to achieve sundry goals or resolve various issues."[4]

This is not, of course, unique to the U.S. All countries suffer from what may be referred to as the "Grand Transportation Mystique" (GTM), which identifies transportation investments and policies as having special attributes for stimulating economic growth or solving problems in other industries. They accomplish such goals by providing lower, preferential fares or rates, expanded capacity, improved service quality and so on without regard to costs or alternative investments or policies that might often prove to be more effective and less costly. There is a belief that transport should be used as an instrument for accomplishing objectives in other segments of the economy or in the "national interest."[5] The GTM is thus a mind-set that leads governments into actions towards the transport sector that more careful thought and better knowledge would indicate to be inefficient and perhaps even counter-productive. These actions take many forms and there are numerous examples, especially in North America. But everywhere these involve enormous resources to preserve parts of a system no longer needed, to expand investment into areas of limited economic potential far ahead of potential need or demand, or to maintain a pattern of regulation that involves considerable economic waste for purposes that become increasingly difficult to explain and more difficult to justify. The GTM also encourages efforts to regulate, subsidize, operate or otherwise dabble in virtually all aspects of the provision of transport services.

To be sure, from time to time the apparent dabbling and/or expenditure may have seemed sound, perhaps sensible, necessary or maybe even "efficient." But as the economy or circumstances change, the consequences of such activities become increasingly dubious, and very costly to maintain relative to any realized benefits. The belated recognition of such past "mistakes" then gives rise to a more or less major "policy change." This study reflects upon the changes that have occurred along these lines in the U.S. with special reference to intercity passenger transportation since the late 1920s.

In Canada the major transportation policy change was identified in the MacPherson Report[6] which led to new legislation in 1967. The new policy emphasized the workability of competitive forces in Canada, especially in the post-war environment, and the resultant desirability of refraining from using any particular mode of transport, especially railroads, as an instrument of national policy. Greater reliance upon market forces was to be counted on in the interests of efficiency and, in general, economic criteria were to be emphasized and regulation minimized. Where subsidy of any kind seemed desirable to accomplish some specific public purpose, the railroads were to be compensated for the losses involved. The previous "monopoly" position treated such loss-generating activities as a kind of *quid pro quo* for past government support and which could then be readily funded by cross-subsidy from so-called captive traffic. Such internal subsidization was no longer feasible under competition and never very economically efficient.

While the MacPherson Report focussed mainly on railroads and freight, it encompassed all modes. As the Report itself noted, the "freight rate inequity problem" was its "principal raison d'être."[7] Yet the emphasis upon the pervasiveness of competition in transportation certainly was believed applicable to passenger transportation as well. Rail passenger deficits were uneconomic and to be eliminated as the public had indicated its preference for other modes of travel.[8] Intercity passenger travel was mainly an afterthought or ignored altogether in most major U.S. transportation reports that I have been asked to examine (see Table 1) except for the adverse impacts of passenger deficits on the rail freight business. But the MacPherson Report stands out among its would-be U.S. counterparts as having taken the lead in establishing a major policy shift towards the totality of commercially provided transportation. Not a single U.S. report was so far ahead of the general economic philosophy of the government at the time. In fact, MacPherson led to a consensus in favour of change in Canada and paved the way for major legislative change within six years.

Similar sentiments were brewing at the same time in the U.S. but no study or report succeeded in capturing the flavour of what needed to be done with sufficient persuasiveness or power to culminate in implementing legislation. Indeed, the requisite legislation did not even begin in the U.S. until the late 1970s and early 1980s. The various U.S. reports, studies and the like mainly reflected a growing consensus among those interested in transportation (including academics, politicians, lawyers, regulators, providers of transportation services, shippers as well as intelligent and concerned laypeople) that existing arrangements were becoming increasingly counterproductive and that alternatives were needed. References to U.S. reports in this study are mainly included to highlight the slow and tepid approach to substantive revision of U.S. transport policy compared with Canada. In only one major aspect was the U.S. ahead of Canada; Amtrak was created in 1970 while VIA Rail was delayed seven years, hardly something to be proud of under a transport philosophy stressing market forces and elimination of most non self-support services.

Table 1
MAJOR U.S. TRANSPORTATION POLICY REPORTS AND STATEMENTS

1. U.S. Department of Commerce, Office of the Federal Coordinator of Transportation, *Passenger Traffic Report* (Washington, D.C.: Government Printing Office, 1935). And various other reports of the Federal Coordinator.
2. U.S. Department of Commerce, *Modern Transport Policy; Documents Relating to the Report of the Presidential Advisory Committee on Transport Policy and Organization and Implementing Legislation* (Washington, D.C.: Government Printing Office, 1956). (The Weeks Report.)
3. Interstate Commerce Commission, *Railroad Passenger Train Deficit*, Report prepared by Howard Hosmer, Hearing Examiner, et al., ICC Docket No. 31954, 1959. (The Hosmer Report.)
4. U.S. Senate, Special Study Group on Transportation Policies in the United States. *The Doyle Report: National Transportation Policy*, (Washington, D.C.: Government Printing Office, 1961).
5. Special Message to the Congress on Transportation, by President Kennedy, The White House, April 5, 1962.
6. U.S. Department of Transportation, U.S. Federal Railroad Administration, *Report on the Potential for Integrating Rail Service Provided by the National Railroad Passenger Corporation with Other Modes* (Washington, D.C.: Government Printing Office, 1976).
7. National Transportation Policy Study Commission, *National Transportation Policies Through the Year 2000* (Washington, D.C.: Government Printing Office, 1979).
8. U.S. Department of Transportation, *Moving America* (Washington, D.C.: Government Printing Office, 1990).

## THE SUBMERGENCE OF EFFICIENCY CRITERIA

It is not immediately obvious why the U.S. delayed so long in implementing the kind of change in policy that Canada had accomplished by 1967. The Canadian environment was certainly less structurally competitive than that of the U.S. With only two major railroads and air carriers, a less ubiquitous highway system than the U.S. and generally smaller domestic markets, competition in Canadian transportation would have appeared to be less workable. Given Canada's lesser emphasis upon market orientation, or "capitalism" in general, the move to deregulate a substantial aspect of the economy was a bold one that might have been expected first from the U.S., especially in an area deemed as important and historically significant as transportation. Certainly U.S. economists did not lag behind economists in Canada in their analysis of the need and enthusiasm for transport regulatory reform. Many even testified before the MacPherson Commission hearings and strongly supported the final report. Most loudly cheered the passage of the *National Transportation Act of 1967* and widely proclaimed that Canada had indeed taken the lead in developing sensible economic policy toward transportation, a lead that the U.S. should promptly follow. However, more than a decade was to elapse before the U.S. got around to serious policy revisions. Even then they were partial and modal.

Thus one of the themes to be explored in this essay is why the long delay and more important, why ad hocery with respect to transportation policy persisted for so long in the U.S. It was surely not too radical to adopt an alternative that emphasized efficiency and market orientation or at least an approach that sought to assess the benefits vis-à-vis the costs of alternative and existing policies much earlier, especially in the bastion of *laissez-faire.* Certainly the virtual ignoring of efficiency criteria prior to the 1960s in Canada and the late 1970s in the U.S., as well as the earlier timing of the pro-competitive policy in Canada, cries out for explanation. The almost exclusive concern in U.S. transportation policy has been for something vaguely defined as the "national interest" which had a heavy dose of defence in it, to say nothing of "regional development or balance." Both of these notions are deliciously vague but when mixed with emphases upon "equity," "justice," "reasonableness," "fairness," "adequacy" and so on, they defy conceptual or empirical clarity. Since the goals of transport policy were never clearly spelled out, the ingredients of policy could not be related to any purpose.

Thus for example, the first explicit statement of national transportation policy in the U.S., which appeared in the *Transportation Act of 1940* is a welter of ambiguity. It reads as follows:

> It is hereby declared to be the national transportation policy . . . to provide for fair and impartial regulation of all modes of transportation subject to the provisions of this Act, so administered as to recognize

> and preserve the inherent advantages of each; to promote safe, adequate, economical and efficient service and foster sound economic conditions in transportation and among the several carriers; to encourage the establishment and maintenance of reasonable charges for transportation services, without unjust discriminations, undue preferences or advantages, or unfair or destructive competitive practices; to cooperate with the several States and the duly authorized officials thereof; and to encourage fair wages and equitable working conditions; — all to the end of developing, coordinating, and preserving a national transportation system by water, highway, and rail, as well as other means, adequate to meet the needs of the commerce of the United States, of the Postal Service, and of the national defense. All of the provisions of this Act shall be administered and enforced with a view to carrying out the above declaration of policy. ('54 Stat. 899, 1940.)

To be sure, all policy statements are vague and general. This one at least mentions the word "efficient" but it is buried or lost amid notions of "just," "reasonable," "undue," "adequate," etc.

Under this rubric and even earlier, the Interstate Commerce Commission (ICC) for example, concerned itself about the stability of the railroad rate structure, about the need to preserve "common carriage," about the need to prevent any regulated mode of transport from driving another mode out of business or even one common carrier "injuring" another. Common carriers were to "share" markets, not compete against each other, in the search for "preservation of inherent advantages." Sometimes these *desiderata* were invoked for purposes of national defence,[9] sometimes for the needs of shippers and passengers or for something else entirely such as "stability." Transport regulation often vacillated between protecting the public and protecting the firms regulated. Too often many of the markets were preserved for a selected number of regulated common carriers thereby creating monopoly or oligopoly — like situations which were then used as justification for continued regulation. The entire airline passenger industry was effectively cartelized by the Civil Aeronautics Board (CAB) for 40 years after its formation without consideration of its competitive possibilities or in the nave belief that all transport competition was "destructive." The courts occasionally reminded the regulatory commissions that they were not given carte blanche authority to create a cartel out of a competitive situation.

At the same time, no regulatory agency was able to ensure that carrier costs were minimized for any level of output because there was no way to determine the costs or quantities of particular inputs, the technology employed or managerial aptitudes. The cost side of carriers' operations were beyond the control of regulation. In the absence of competitive pressures and with the inability to compete on a price basis, regulated transportation was inefficiently provided. If we add to this the "other" costs of regulating, such as the deliberate creation of excess capacity (for defence purposes, of course), the costs of running the regulatory agency itself, the wastes involved in the innumerable and lengthy cases designed to give "due process" to all whether or not directly involved, the diversion of managerial talent from running the business effectively to taking care of matters of regulation and so on, it is clear that the regulatory aspect of public policy, so pervasive but uneven in transportation, pretty much ignored efficiency of production.

Since the other main aspect of public policy, namely provision or financing of infrastructure, was also bereft of sensible investment or benefit-cost criteria, it is evident that efficiency considerations got short shrift. In fact, anti-efficiency sentiment was so strong that attempts to make public investment in transportation subject to such criteria were systematically expunged from any proposed legislation. Nor has there been much success in developing an efficient set of user-charges for publicly provided rights of way.

Thus while the major thrust in the U.S. over the past decade has been in the direction of market forces and efficiency, there is considerable distance yet to go in terms of public investments, user-charges and even adequate enforcement of antitrust laws to forestall anti-competitive mergers and practices. But the approach to change in transportation policy and the more overt economic goals suggest at least a conceptual clarity. There is now a greater willingness to view transportation as analogous to other industries with no unique aura or magic entitling it to special attention. The GTM has been tarnished at least. It is, and ought to be, subject to the regular impacts of supply, demand, competition, technology and so on affecting all productive aspects of the economy and judged by similar criteria. The prime goal of transportation policy should, therefore, be "Efficiency within transportation, both in terms of use of existing infrastructure, vehicles, and rolling stock . . . and in terms of investment criteria . . . deviations from which require special justification. . . ."[10]

## THE DISTINCTION BETWEEN PASSENGER AND FREIGHT TRANSPORTATION

Throughout the changes in U.S. transportation policies the emphasis has almost completely been on freight transportation. The original *Act to Regulate Commerce*, 1887 was the result of shippers' complaints of excessive rate discrimination; although written with sole regard to freight, it was made applicable to rail passenger traffic as well simply because rails provided both services. Bus service was included in the *Motor Carrier Act of 1935* virtually as an afterthought. Relatively few cases or proceedings were held in connection with bus transportation compared with intercity truck commodity movements. Even the creation of Amtrak was less a direct passenger-oriented measure than a means of bailing out the railway freight industry from ever-increasing passenger deficits. Almost all changes affecting passenger traffic have come about through attempts to respond to problems originating in the movement of freight. This is true of the MacPherson Report as well.

Joseph B. Eastman, one of the most important American regulatory commissioners ever, plaintively remarked in 1936 that "passenger service should not be considered and dealt with as an unavoidable but unwanted stepchild of railway operation."[11] Yet as far as *commercial* passenger service is concerned, aside from airline policy, passenger traffic has received little overt attention. This should not necessarily be lamented. Many of the carriers receiving most of the regulatory attention often wished they had been less "favoured." Even the airlines, overwhelmingly a passenger mode, received their early subsidies in the U.S. not on the basis of the number of passengers or passenger miles, but as "mail-pay" (that is, goods movement) contracts. The subsequent deregulation was based upon earlier arguments made for freight markets in general and preceded by prior deregulation of air cargo. The statement of national transportation policy in 1940 noted above omits explicit reference to air transportation probably because the latter deals mainly with passenger traffic. As one of the few texts on passenger transport puts it, "the subject of this declaration is really freight transportation."[12] In fact, air regulation was at one time to be placed under ICC jurisdiction but fear of overloading the Commission already swamped by being given jurisdiction over motor carriers in 1935,[13] led to creation of a separate commission which later became the Civil Aeronautics Board.

The assumption underlying the lack of distinction between passenger and freight transportation is that the differences between moving people rather than goods are not important. Furthermore the relative indifference regarding commercial passenger travel from a policy perspective is doubtless related to its small amount compared with total intercity passenger traffic. Passenger revenues were never a very large proportion of total rail revenues and ever since the ICC kept the data, from 1936 until the creation of Amtrak, rail passenger traffic, leech-like, recorded deficits which were made up from net revenues from goods movement. The massive highway programs of the U.S. and the concomitant development of the private automobile have relegated the size of the entire commercial intercity passenger market to somewhere between 10 and 15 percent of the total. The vast majority of the populace have feasible travel options somewhat independent of air but obviously independent of bus and rail, in the sense that, if the latter two simply disappeared, the *national* inconvenience would be slight.

What are the differences between passenger and freight transportation and do they matter as far as public policy is concerned?

There are some obvious differences between people and goods transportation. Service quality is more important for passengers than freight. Comfort of the ride is qualitatively different and more significant for people. It may be an overstatement but there is some truth in the assertion that "getting there is half the fun." Passengers have to be individually placed and guided to often pre-arranged seats unlike tons of coal or even packages of freight, and then must be more or less "entertained" *en route*. The terminal facilities need to be of considerably higher quality for people. Whether they had to be the opulent structures of many of the old railway passenger terminals which became landmarks in many parts of the country, a kind of North American substitute for European castles, is not clear. They must however be especially well organized to move people on and off vehicles or aircraft with a degree of convenience, care and dispatch unnecessary for goods. Baggage handling is another function that occasions special handling, extra costs and more careful organization. Unlike freight, passengers can also complain. Although freight shippers often voice their opinions of the service, there are fewer of them than there are passengers, and the complaints are likely to be of a different sort. The quality dimension of passenger service is thus likely to loom as far more important and of a different kind than for commodities.

All this suggests that passenger cost functions are likely to differ from those of freight depending upon the mode — air, rail, bus or water. To be sure, analytically there is no reason why a cost function related to an output unit called ton-miles rather than passenger-miles should differ in general shape. Indeed, economic analysis, in seeking to be general, makes no distinction among the various kinds of output or output units and remains wedded to a theory that leaves the output unit carefully undefined and unspecified. It thus makes no difference whether output is something physical (such as tons of steel, bushels of wheat, units of homogeneous widgets, etc.) or some non-storable service, (such as transportation, entertainment, medical treatment, etc.).

If no distinction is made between physical and service units in general economic analysis, it is scarcely to be expected that passenger-miles and ton-miles would get separate treatment although neither of these often-used transport measures can be construed as homogeneous. That is another and longer story that I have dealt with elsewhere and which needs no elaboration here.[14] Suffice to say that a proper conception of output units is essential not only for empirical research on both cost and demand functions but to pin-point that elusive but important concept in economics, *marginal cost*. We need to know marginal cost of *what* for pricing and costing purposes and for different qualities of any quantitative output unit. Fortunately much progress has been made along these lines.[15] But the lack of widespread concern over output units has made it easier to ignore the distinction between moving things and people. Both involve "transport" and for many that is good enough.[16]

Furthermore the nation's estimated freight bill is vastly in excess of the estimated passenger bill if we exclude private automobiles. Some estimates suggest that the freight bill is some five and a half times larger than the passenger bill and that this has remained fairly stable over the years.[17] Thus the insignificance of commercial passenger travel relative to freight movements in the U.S. may account for much of the neglect of the former and would partly explain the concentration of regulatory policy changes over time on the freight aspects of transportation. People-movement is overwhelmingly by private car and not for profit and thus not subject to the kinds of economic or business constraints oriented to competition control, profit regulation and route, back haul and other restrictions. Indeed, freedom of travel along publicly provided rights of way in one's own vehicle is taken for granted. Automobile ownership is now virtually universal in the U.S. Yet this was not always the case and during earlier periods, say the 19th century, freight still ruled the aim, end and process of policy formation.

Hansen has remarked that the "distinction between freight and passenger transportation was often obscured" but that in the "developmental context" this was of little importance. In the 19th century, "Freight and passenger traffic would thus both have to be served . . . and railroads, turnpikes and waterways carried significant amounts of each. It was common to lump both together by viewing these transportation facilities as 'means of communication'."[18] Thus the opening up of the west, for example, required both people and commodities to move back and forth. Settlers could be herded into freight trains and "shipped" west like other "commodities," including settlers' effects. In fact, many were.

The foregoing suggest several reasons why the distinction is more significant than it might have seemed in the past. One is that the safety issue now looms larger. The difference between loss and damage claims for commodities is of far less concern than death and injury to passengers. In a nation spending vast amounts to improve the health and safety of its citizens, death and injury from transportation of people has taken on new importance. This of course includes private automobile travel as well. But concern for such issues has risen from a fatalistic "acts-of-God" notion to one that society has created by its own technological advances in transportation and elsewhere. It is now incumbent to direct resources to alleviate such hazards to the extent possible. Highway and airway safety concerns have taken on new dimensions as new technologies both create more potentially dangerous situations and provide increasing opportunities for remedial or preventive actions. These include the so-called "smart" cars and highways, improved aircraft guidance and control systems and soon, stricter safety enforcement measures and the concomitant rise of damage claims for safety violations and accidents. In short, the provision of passenger service by any firm is attendant with concerns for the safety of the passengers that is greater than those in the case of freight.

In addition, comfort has now become far more significant if only because the private car provides a convenient reference point for both comfort and convenience that is hard for a commercial carrier to match. A successful commercial operation requires a degree of concern and ability to address these matters which are highly personal, that no freight agent ever had to contend with.

This suggests several things. Since the cost and demand elements are so different in the markets for freight and passenger intercity transportation and since societal rules of the game, so to speak, have shifted substantially in the direction of human safety and comfort, and other quality dimensions, the capabilities of those providing passenger services are significantly different from those who transport goods. What is an adequate railroad bed for freight traffic will no longer suffice for the smooth ride demanded by passengers accustomed to smooth highways or airways. Indeed new transport technologies, such as maglev need their own distinct right of way. It seems clear that rail passenger traffic will require separate, differentially maintained and perhaps unique rights of way if railways are to carry people. More generally, the present trend toward separate management of goods and people movement will probably continue. Air, truck, rail and water cargo carriers will increasingly involve companies totally divorced from significant passenger movements and vice versa. Amtrak and the other proposals for high-speed rail passenger intercity travel involve self-owned rights of way and separate corporations or ownership. No longer can one expect a single railroad to move relatively large numbers of people in a predominantly freight business.

The 19th century, North American model of development, which had to cope with substantial empty spaces required both people and goods, as Hansen has noted. People were needed for labour to produce a surplus and to create demands for production materials and consumption; goods were needed for export and import for both purposes. Thus a two-way, in some sense, equivalent movement of people and goods was crucial. The catalyst in all this involved some means of conveyance and rights of way. The better these were, the faster the development, or so the story went in Canada and the U.S. Probably this was the origin of the Grand Transportation Mystique. However, now that there are far fewer empty economic or geographic spaces, the people movement aspect of the developmental model drops relative to inter-regional goods movement associated with the geographic specialization already in place. There is still much people mobility but less associated with permanent settlement or even business than was the case before, say World War II. Tourist travel now predominates over people as settlers and labour. The travel is now more round trip than earlier (some states and areas discourage new settlement)[19] and more frequent which means providers of passenger transport service must pay closer attention to comfort, convenience, cost and price than earlier. There is also more competition for the traveller's business than in the pre-war period in part because of higher incomes, more leisure time and an aging population.

In short, the movement of people and the movement of commodities represent two different industries, more distinct than ever before. Thus whatever regulation is applied to one in response to a particular set of problems is unlikely to be relevant to the other. This does not mean that a national transportation policy stressing efficiency or even nationalistic criteria cannot be formulated in a very general sense analogous to, for example, antitrust policy with an emphasis upon infrastructure. Whatever form such a policy may take however cannot avoid the increasing distinctiveness between the two industries.

## THE ROLE OF ECONOMISTS

Another aspect in interpreting the evolution of U.S. transportation policy, and in particular the sea-change associated with the MacPherson Report in Canada and the various deregulation bills finally passed in the U.S. in the late 1970s and early 1980s, is the role of economists and economic analysis.

Economists have long had a special interest in transportation. Since much of the infrastructure has been provided and/or subsidized by governments, problems naturally arise of the proper capacity to create and how to finance it efficiently. These also include issues of pricing of publicly provided facilities, efficient user-charges, taxation, deficits in governments and so on, all problems that represent the economist's bread and butter. Transportation firms are of considerable interest as well, especially the railways with their "unusual" cost structures which early on led to investigation of imperfectly competitive markets.

The economic analysis of regulation began (in the U.S. at least) when the railroads were subjected to the *Interstate Commerce Act*, the first major U.S. private industry to be so treated. It is not therefore surprising that most of the well-known, mainstream, general economic theorists at one time or another and from a relatively early date devoted some attention to transportation. For example, one of the founders of the marginalist "revolution" in economics of the 1870s, William Stanley Jevons, got his notion of the "margin" and emphasized the use of mathematics and statistics from his study of railroads in Australia. A. C. Pigou in his classic work *The Economics of Welfare* (1924) devoted an entire chapter to "The Special Problem of Railway Rates." He also engaged in a vigorous debate with another mainstream economist, Frank Taussig, as to whether "charging what the traffic will bear" in railway rates was to be explained in terms of monopolistic discrimination or in terms of joint costs.[20] Many years later, Edward Chamberlain developed monopolistic competition theory from doing a term paper for a transportation course on the "famous" Pigou-Taussig controversy. The great Swedish economist, Knut Wicksell devoted many pages to railway pricing and rational regulation of industrial monopolies before World War I in his *Lectures on Political Economy*. Other prominent mainstream theorists such as J. M. Clark, Francis Edgeworth and Frank Knight also contributed to transportation before the early 1920s.

However, beginning in the 1920s, transportation matters elicited little further interest of important general economists. This is doubtless explained by a shift of focus to more burning questions such as the aftermath of World War I, the German hyperinflation of 1919–1923, the onslaught of the Great Depression in 1929 and World War II only 10 years later. Transport problems then retreated from the mainstream of economic analysis in favour of these more serious and vexing issues and became the subject of a small subset of economists who chose to specialize in transport matters.

This is not to say that transportation problems were not severe in the decades following World War I but so were those of most other industries and indeed the whole economy. There seemed to be nothing special about transport in this context. Various legislative Acts were passed in the U.S. that were not very carefully thought out and were generally opposed by economists, especially the *Motor Carrier Act of 1935* which seemed to be a case of wilfully misguided regulation where none was warranted, certainly by the industrial structure of trucking. However, little new analysis was presented, and the ignoring of transportation by mainstream economists meant that they were little consulted or heeded on such problems. Until the late 1950s transport economists wrote textbooks that were heavy on history, law, regulatory and carrier practices but woefully short on evaluation, analysis and critique. As has been said, "The economic theorists believed that all the major problems in the area [of transportation] had been so well resolved that further study of them would be unrewarding."[21]

Then in the late 1950s a series of works that applied up-to-date critical analyses to transportation matters renewed the interest of mainstream economists in transport. It signalled the rebirth of transportation as an important and meaningful branch of applied economics. Noteworthy is that this renewal was coincident with the policy changes associated with the MacPherson Report and the Message on Transportation by President Kennedy in the early 1960s. Indeed this marked the beginning of the deregulation movement and its capture by economists. Adam Smith had been rediscovered and the new microeconomics was recognized as applicable, meaningful and relevant for the over-regulated, financially strapped, differentially cartelized transportation industries.

Resources in transportation were seriously misallocated because of past regulation. Change was essential to avoid increasing economic waste and to stimulate innovative practices, new technologies and reinvigorate competition. The President's Council of Economic Advisors began its non-stop critique of transport regulation, and President Johnson even declared before his Transportation Task Force that transportation was the nation's number one priority! Thus began the U.S.'s long struggle to effectuate policy reform. The story will be outlined in later sections. Suffice to note here that President Johnson was side-tracked from his zeal to tackle transport policy by the civil rights movement and the escalating Indochina war. However, many economists became firmly aligned with the struggle and indeed were appointed to various government positions from which they could more directly and powerfully move forward the deregulatory agenda. The most dramatic appointment was that of Cornell economist, Alfred E. Kahn, to the head of the Civil Aeronautics Board (CAB). Having earlier declared that "applied microeconomics is the exciting new frontier of public policy,"[22] he went on to promise application of rigorous efficiency criteria to all regulatory matters and ultimately eliminate economic regulation entirely, and with it the CAB itself. He was hugely successful.

By 1980, the regulatory reform movement had achieved substantial success with both air cargo and passenger transportation rid of "artificial" economic constraints two years earlier. The firms were given (some with reluctance) free entry and exit and pricing freedom subject only to the antitrust laws and safety regulations. In 1980 the railroads were provided a higher degree of pricing freedom and easier conditions of exit[23] and motor carriers got freedom of entry as well as exit, thereby eroding the scarcity value of previously granted operating certificates, along with a large dose of pricing freedom. Household goods carriers were similarly deregulated in 1980 and interstate bus operations in 1982, as a kind of afterthought so typical of the policy approach to passenger transportation.

It is interesting to note that the economic arguments leading to transportation deregulation and their subsequent success in both Canada and the U.S. stimulated the worldwide swing toward greater reliance on market forces, deregulation and privatization which ultimately led to the utter disparagement of the kind of socialist and communist economic planning replete with state-set prices and monopoly under petty tyrants and unpleasant dictators found in Eastern Europe and much of the rest of the world. It also presaged the end of the war between communism and capitalism since the former could neither produce the goods and services nor provide freedom or much security outside of prison. From Khrushchev's empty threat that "we will bury you" to Gorbachev's "we will deny you an enemy" implies a massive leap in visions of appropriate economic institutions. Much of the rethinking of the microeconomics of regulation and the emphasis upon market-determined prices and efficiency as the desired over-riding criterion of public policy towards transportation that took place in North America from 1960 on, and the successful implementation of policy change, paved the way for the worldwide reemphasis upon market forces. This was indeed "the economist's hour."

## 2. THE PERIOD BEFORE 1930

The two main aspects of federal government transportation policy between 1930 and 1991 were the development of the transport infrastructure and the terms and conditions for the use of such infrastructure, namely regulatory policy of both the economic and safety variety.

### INFRASTRUCTURE POLICY

#### Highways

Although early involved in building the Cumberland Road, completed in 1844, the federal government withdrew from further highway construction for almost 50 years on the grounds that such outlays were unconstitutional and, in any event the states' requests for highway funding were many times the size of the federal government budgets at the time. Such roads as were built, sometimes stone overlaid with gravel but usually dirt piled upon logs (corduroy roads), plank roads or simply scraped and widened dirt trails, were mostly financed by state and local communities and operated as turnpikes. Sometimes private companies built roads but many of these reverted to state or local agencies when profit prospects dwindled or disappeared. The railway era especially after 1850 reduced the need and incentive to produce highways for the then existing horse-drawn vehicles. The railways had both a better right of way and the requisite vehicles and horseless motive power, to boot. Furthermore the railway right of way was privately financed although heavily supported by federal land grants. Further development of road transportation clearly awaited a new vehicle and especially a new method of propulsion which became available only in the early 1890s. Yet the highways of the U.S. were probably in worse condition through the early 1900s than they had been 40 years earlier when they were generally described as atrocious.

The reason for the demise of the road system, or rather road segments and patches, was the loss of traffic, both passenger and freight, to the railroads which, from mid-century on, dominated transport in the country. Railroads are believed to have provided some 95 percent of intercity passenger trips by the 1890s. This destroyed the turnpike companies which let the roads fall into a state of almost complete disrepair. Ultimately the responsibility for these roads reverted to local government which generally was ill-equipped and too financially strapped even to maintain let alone to expand them. The position of county road overseer degenerated into a mere sinecure. The highway "system," which had shown some signs of acquiring a real interstate character, became fragmented and run down. This was no great threat to national unity nor economic progress at the time because of the vigorous and expanding railroad system; it was the more localized and intrastate transport needs that progress had temporarily by-passed.

The inadequate and deteriorating road system became increasingly intolerable after 1890. The demand for improved and extended overland right of way soared for three main reasons: the bicycle craze, the initiation of free rural mail delivery, and the development of the automobile.

The "good roads movement," as it came to be called, sought to eliminate the disparities between rural and small-town living on the one hand and urban areas well connected with the national economy on the other. Since railways by their very nature could not be as ubiquitous as roads, this seemed like a good place to start. By 1890 the bicycle manufacturers had begun their campaign for road improvement. Cyclists obviously wanted passable roads, and road improvement was believed to be important for national economic growth. Surprisingly the railroads strongly supported the bicycle crusade believing that the national economy would benefit, thereby increasing their business, and that road transport could never be anything but ancillary to the railroads.

Free rural mail delivery, after a false start, resumed in earnest in 1896 to provide service to villages with populations of less than 10,000. By 1900 over 4,000 routes had been established. Since the Post Office Department had ruled that service was contingent upon the availability of adequate roads, residents began clamouring for them more and more vigorously. Realizing the importance of this service for national unity as well as the obvious political, social and economic advantages of a more ubiquitous and diversified system of communications, the federal government proposed to make financial aid available to state and local governments. It was not however until 1916 that federal legislation was passed.

In the meantime the third factor in the rise of the public demand for good roads, the automobile, was beginning to make its appearance. Although only 8,000 vehicles were registered by 1900, the potential demand was already obvious. The big need was decent roads on which to drive the new machines. Thus the automobile manufacturers and owners' associations added their voices to the good roads movement.

As a result of these efforts, state aid began to be offered for highway construction. The state of New Jersey in 1891 argued that "public roads within a township were constructed for the convenience of the citizens of the counties in which they are located, and of the entire State as well of said townships."[24] The law also provided that the cost of road construction would be split among the adjacent property owners (10 percent), the state (33 1/3 percent) and the county for the remainder. Other states followed suit so that by 1917 all 48 had some form of highway aid program.

To provide for interstate needs, the federal government needed to become involved. Earlier it had organized the Office of Public Roads Inquiry to undertake research in road construction methods and to publish the results.

However, when it came to authorizing public funds for highways, considerable opposition arose which was not successfully repulsed until 1916 when President Woodrow Wilson signed *An Act to provide that the United States shall aid the States in the Construction of rural post roads, and for other purposes* or, more simply, the *Federal Aid Road Act.*[25] The rationale for federal assistance was the more effective performance of government functions and although not clearly stated, the promotion of interstate commerce.

It is perhaps not coincidental that by 1916 more than 2.5 million vehicles were registered in the country — a sharp growth over the 8,000 in 1900. Even without federal aid the automotive revolution had begun with a vengeance. With such, on top of state and local financing, the highway boom took off. To secure federal aid each state was required to assent to the provisions of the Act and create a state highway department capable of supervising construction and maintaining the designated highways. The aid was limited to post roads and in an amount not to exceed half the cost. The 1916 legislation was supplemented in 1921 by the *Federal Highway Act* that promoted an interconnected national highway system by apportioning funds to each state on a formula basis, the exact amount however depending on Congressional appropriations. Partly through these stimuli as well as the generally prosperous conditions of the 1920s, the mileage of surfaced highways grew from 154,000 in 1904 to almost one million by 1934.

## Railways

The story of the railroads is more familiar and will be treated briefly. Passenger miles peaked in 1920 and fell through 1933, the depths of the Great Depression. Even before the beginning of this severe contraction, traffic had declined over 50 percent by 1929 indicating that this was not merely a cyclical phenomenon. Indeed it continued, except for the World War II years, until the railroads succeeded in divesting themselves of the passenger business and most of the directly related equipment, much of it antiquated, to the new government-formed National Railroad Passenger Corporation (Amtrak) in 1971.

The development of the railway infrastructure was significantly stimulated by federal aid mostly in the form of land grants. Although the concept of land grants was not new, having been used on a modest scale for canal development and navigation improvements on rivers and selected highways earlier, it was employed on a vastly expanded scale in the case of railways after 1850. Ultimately over 179 million acres were given for railway construction, an area larger than Texas. The purpose of the land donations, beyond that needed for the right of way, was to provide an asset basis against which construction costs could be borrowed or as backing for loans and stock sales. The government retained alternate sections of land in a strip on each side of the rail line to sell later in compensation for the land granted to the railroads at inflated values caused by the economic growth expected to be stimulated by the new transport access. In addition, the companies were not only required to build and operate the railroad for which the grants were made but, in many cases, to move government property and troops over the line free of charge or at reduced rates. Such a subsidy, now estimated to have been totally repaid through the value of reduced rates for government traffic over the years, stimulated railway construction not only in the eastern section of the country already fairly well served by rail, but especially in the west. In fact it opened up the west much more rapidly than would otherwise have occurred. It was part of U.S. "manifest destiny" not unlike the "Canadian dream."

The rapid growth of rail capacity was mainly justified by military needs to secure the west coast from British intrusion as well as to develop the country more fully and exploit not only the land mass thereby made accessible but also the rapidly evolving rail technology. The improved technology plus the sharp rise in traffic reduced average revenues per ton-mile from about eight cents in 1848 to less than two cents in 1870. Costs fell even more in response to efficiency and volume gains. Rail mileage burgeoned from roughly 9,000 miles in 1850 to 53,000 in 1870. It tripled by 1890 and ultimately reached about 253,000 miles, its peak, in 1920. This rapid expansion combined with increased capacity of the track as well as continued improved efficiency of the rolling stock and locomotives, led to such enormous excess capacity that even the rapid growth of the U.S. Gross National Product at the time could not utilize it profitably.

A wave of mergers and consolidations accompanied the rapid expansion of capacity with the resultant development of monopolistic practices — known in railroad parlance as pools, traffic associations, or rate agreements — to maintain not only a stable *level* of rates and fares but a *pattern* of discrimination, euphemistically called the rate structure. Castigated by economists as "value-of-service pricing," such activities caused public outrage and pressures for regulation as early as 1869 in Illinois. This was to culminate in federal regulation in 1887, discussed below.

## Other Transportation Infrastructure

The federal government has only reluctantly taken a supportive role to assist new transport technology whenever its implications seem to stretch beyond the reach of private development even with the help of state and local governments. There is little tendency to examine how the new technology can be made in some sense to "fit in" with what exists; nor has there been much success at evolving an overall "plan." In short, the federal role has remained ad hoc with respect to technology and specific investments emanating from that technology be it highway, rail or air. Up to 1930 at least, the federal government's approach was of modal separation with no major attempt at intermodal coordination. Furthermore the federal role in transport was tepid and reluctant, including only "projects of truly national importance which absolutely required federal intervention to succeed."[26] Each such intervention involved the private sector in the major role of construction, operation, and/or principal risk taker or initiator. None was subject to much economic analysis, most were reactive and all were rooted in optimism, patriotism and nationalism.

In a *laissez-faire* environment, with limited, constitutional government, this was a fitting approach. However, the Great Depression changed all this.

Thus, the pattern emerged whereby initiatives for new technology, arrangements or institutions began in the private sector. If more resources were needed than the private efforts could muster, the next level of recourse was local government, then state and only as a last resort would federal government help be sought and then only if interstate or national interests were clearly involved. This is quite evident in the cases of federal support for highway and railway infrastructure. A similar pattern emerges where certain aspects of private activity are deemed antisocial or detrimental to the economy in some way. The very creation of the Interstate Commerce Commission provides a good example. In all the major transport issues the ultimate involvement of the federal government took many years. In cases of investment or finance, the assistance was piecemeal and specifically circumscribed. No blank cheques were written. Few of the infrastructure investments involved economic or efficiency criteria. Certainly there were attempts to ensure some form of repayment, such as tolls for the Cumberland Road and the alternative parcel of land holdings in the land grant schemes for the railways as well as some other forms of *quid pro quo*. In this, a semblance of "sound" business judgement was present and was used to justify the actions taken. But no overall criteria of investment-type aid included economic calculation. The criteria were mostly defence, some notion of improvements to interstate commerce, opening up the west, manifest destiny and other aspects of nationalistic sentiments. All of these were also quite vague.

This response to pressures from the bottom up does not mean the federal government could not take the initiative when circumstances warranted. The seizure of the railroads during World War I is an example. But by and large the federal government pursued a pretty rigorous, *laissez-faire* attitude when it came to transportation of people and goods and even infrastructure until the situation virtually cried out for involvement at the highest administrative level.

This contrasts sharply with policy initiatives taken in subsequent decades at least through the 1970s. Only during the 1980s and especially in the latest transportation policy pronouncements from Washington do we see an attempt to return to a more bottom-up approach. Largely this has to do with the ideological revival of a thoroughgoing willingness to rely on market forces. It is however closely linked to the budget deficits that have beset the U.S. (and Canadian) federal governments. The return of transport policy more and more to the states and cities reflects a combination of ideology and dearth of financial resources. Policy towards transportation thus appears to have come full cycle. Nor is there much more formal economic analysis regarding transportation infrastructure than in the pre-1930 period. It is not yet recognized in U.S. federal budgeting that expenditures on roads, ports, canals or other physical assets should be treated as investments. There is still no distinction between current and capital outlays in the U.S. accounts. Given the advances made in economic appraisal of public investments, there is much less excuse for failure to do a better job of pre-feasibility analysis than in the past and to continue to rely on vague criteria concerning the national interest, prestige and the usual standby, national defence. Nor is there much merit to permitting the infrastructure to deteriorate or refrain from adding to it when warranted because of fears of raising the deficit.

Another factor forcing the federal government to respond to economic forces in general and transportation in particular was the growing interrelatedness of the economic system. Transport investment was both cause and consequence of this. And with it came the phenomenon of big business which required higher levels of government and bigger size thereof to cope with the problems. Certainly as interstate commerce grew faster than total economic activity, neither local nor state governments had the appropriate jurisdictions to deal legally with ever bigger, interstate companies. The federal role had to increase. The Great Depression simply made it more imperative and urgent. Prior to this it called for different forms of intervention which were ill-understood at the time.

## REGULATORY POLICIES

The latter part of the 19th century and at least until World War I have been described as the "high tide of *laissez-faire*." Keynes exclaimed, "What an extraordinary episode in the economic progress of man that age was which came to an end in August 1914!"[27] Of course it was not such a wonderful era for most of mankind nor even for those living in the fortunate part of the world to which Keynes was referring. Nevertheless the prospects that Marshall held out for "opening up to all the material means of a refined and noble life" were not believed to be far away in the glow of Victorian optimism. Capitalism seemed to be on a roll that even the churlish thunderings of Karl Marx could not deflect. U.S. economic growth from 1850 to the Great Depression was phenomenal. Part of this was no doubt due to the railroads. True, there were those who subsequently questioned whether the railroads really contributed so much. In fact some were unkind enough to suggest that the incredibly rapid growth of railways used up excessive amounts of resources, such as iron and steel, that pr[illegible] were raised excessively and scarcities occurred to the detriment of development of other manufacturing industries. Government support of accelerated growth of the rail network thereby may have slowed down development of the economy elsewhere and perhaps overall. But these caveats were to come later.

At the time, railroads were viewed as the engine of economic growth to say nothing of national cohesion, manifest destiny and the end of poverty. Part of this was doubtless true. At the same time however the railroads had by the 1860s overtaken in size and even influence, most other institutions in U.S. society. They employed many times the number of people than did the federal government. The value of their assets was far greater than those of the largest industrial corporations. It has been argued that their social influence in the late 19th century was akin to that of television in the late 20th century or even Catholicism in medieval Europe.[28] It is true that the railroads created time zones, emphasized punctuality, seemed to be the essence of economies of scale and hence "natural monopolies," dominated many a state legislature, browbeat and swindled local communities and otherwise rode roughshod over much of American society, economy and polity for several decades. This posed an enormous challenge to free markets to say nothing of individual freedom and political democracy. Big business first reared its ugly head in the form of a railroad, which the federal government had even assisted in creating!

Partly due to its economic characteristics, namely the large proportion of its costs that are joint, fixed and/or otherwise indivisible or non-allocatable on cost-occasioned criteria, a railroad must charge a price, rate or fare for particular traffic that is differentially in excess of marginal cost. In its most sophisticated and socially acceptable sense this is referred to as "Ramsey pricing" or maximization of profits subject to a revenue constraint which is now not only permitted but legally required by the *Staggers Rail Act of 1980*. In its cruder form before 1930 it was viewed as flagrant discrimination which it often was. One form of it especially annoyed farmers, namely when railroads charged more for a short-haul movement of the same commodity than for a longer haul over the same line and in the same direction! Such a violation of the view that prices should bear some, however vague, relation to costs aroused passions. It seemed manifestly unfair. This kind of pricing combined with secret rebates to favoured shippers, frequent and apparently whimsical rate changes, chronic rate instability, general railroad arrogance and arrangements among railroads not to compete on price or service as well as to pool traffic — much like OPEC attempts to assign oil production quotas at present — led to considerable agitation on the part of small shippers mostly of farm products especially in the mid-west. They succeeded in convincing several states, notably Illinois, to pass what came to be called Granger Laws which set permissible freight rates by a regulatory commission or a legislature, prohibited long-short haul discrimination as well as free passes to public officials and in other ways sought to restrict certain dubious practices that had emerged in the provision of rail transport. Although later repealed, most of these laws were upheld on the constitutional grounds that rail transport was "affected with the public interest" and that railways were in fact "common carriers." The latter is a concept dating far back in British common law and creates certain obligations upon those holding themselves out to provide the public with some specific service such as inns, transport providers and others. It implies among other things that prices will be published and not changed without prior notice, that all who request the service will be provided without discrimination at such prices, that common carriers assume certain liabilities for loss and damage and other transportation-related matters.[29]

Federal action was finally required when the courts held that a state could not control rates on interstate traffic. Since most of the traffic by this time (1887) was interstate, the need for federal legislation was apparent. Finally, and after many years of effort, the *Act to Regulate Commerce* was passed in 1887 by Congress. It stressed that the primary evil to be remedied was freight rate discrimination although it applied to passengers as well.

There remains some controversy concerning the "real" reason the railroads became the first major private business to be subjected to federal commission-type regulation. The conventional wisdom has it that the companies so abused their excessive amount of economic power that the government was forced to retaliate by special regulation, even of otherwise sacrosanct private property, to eliminate abuses and provide suitable punishment as a preventive. It has more recently been argued that the railroads themselves invited regulation to implement a more effective cartel since their pooling arrangements frequently broke down and "cut-throat" competition erupted.

The truth seems to be that railroad arrogance and behaviour were the ultimate reason for the introduction of regulation. People had been so aggravated along with obvious abuses, that for the previous 20 years some 150 separate bills had been introduced in Congress. Finally when the Wabash case invalidated state regulation of interstate commerce, some kind of federal control seemed likely to pass. At this point the railroads recognized that "we must make up our minds to it" as one railway president put it. After that, the attention of the companies focussed on making the regulation as palatable and innocuous as possible. At least something better than the tough state regulations seemed preferable.

And so the Act was passed. President Cleveland signed the bill which declared railroads to be common carriers; created a five-man commission; outlawed pools and rate discrimination; required that all rates and fares be just, reasonable and published; authorized the Commission to investigate any interstate railway; empowered it to compel witnesses to testify and to secure relevant documents; and required railroads to submit regular reports and adopt a uniform accounting system. At the end of March 1887, with five Commissioners and 11 staff members, the Interstate Commerce Commission set out to eliminate abuses of economic power by the largest industry in the country, at the time employing about 800,000 workers and having over 100,000 miles of track and abundant other capital assets. Hope ran high. One newspaper proclaimed that "the *Interstate Commerce Act* is working wonders and the rail magnates are trembling," after several early decisions. Alas this was not to be the case until over 20 years later.

As the Commission sought to enforce its rulings and to behave as it correctly believed Congress had desired, the Supreme Court systematically emasculated all of the authority the ICC thought it had in a series of rulings extended over the next 15 years. By 1903 the Commission lamented that all it could do was "investigate and report and such orders as it can make have no binding effect."

This was also the era of the so-called "first merger movement" which radically transformed the structure of American industry. The merger mania, it should be noted, took place within a short period of time following the passage of the first federal antitrust law, the *Sherman Act*, in 1890. The attempts to restrain the development of monopoly power in the first place fared no better than the attempts to restrain its abuse once "naturally" acquired as was presumed in the case of railroads! The U.S. government was thus called upon to seek to make the 1887 transport act effective and at the same time create a climate wherein most other industries would be restrained from cartelization or at least from more industrial concentration than had already occurred between 1897 and 1904, the period of the first merger movement.

Antitrust was more difficult to make effective because the courts were unwilling or unable to unscramble the corporate eggs once blended, and fine legal distinctions began to be made between "good" and "bad" monopolists. The antitrust laws with no regulatory commission or agency at this time (the Federal Trade Commission was created in 1914) were to be enforced by the Department of Justice through the courts, something that commission-type regulation was seeking at least partially to avoid but which the ICC to this point had not yet accomplished.

The Interstate Commerce Commission however fared better than did antitrust activities. By 1910, through a series of new enactments, Congress restored to the Commission all the original powers it thought it had previously given. At the same time the courts limited their right of judicial review of ICC findings and judgements. This change occurred because of the immense support by the activist President Theodore Roosevelt of railway regulation and the ICC in particular, as well as the growing public opposition to the railroads and the other "malefactors of great wealth." In any event, the ICC had a second chance. Unfortunately the Commission squandered its opportunity and with its now considerable strength it essentially preserved the *status quo* with regard to the rate structure and collective rate-making by the carriers themselves in rate bureaus. It also denied a series of general rate increase requests by the railroads or sanctioned lower increases than in retrospect were needed.

The exigencies of World War I and confusion and division within the ICC induced President Wilson to exert federal control over the whole railroad system in order better to co-ordinate traffic, among other things. The ICC was not believed capable of doing the job. The federal Railroad Administration was set up in 1917 and by its general Order No. 1 the Director General of Railroads required the pooling of all equipment and facilities, ordered new routings regardless of previous arrangements, denied shippers the right to route and sought to operate all railroads as a single *national* system.

At war's end, the shippers clamoured for the return of the railroads to private operation and ICC regulation probably because the Commission had resisted rate increases despite an acknowledged need that was acquiesced to under government controls. Others wanted nationalization and fashioned plans that received some attention. However, *laissez-faire* principles were so firmly embedded that not only were the plans rejected outright but attempts to extend the period of federal control were ignored. Instead Congress passed the *Transportation Act of 1920*. This broadened ICC authority, legalized railroad combinations subject to an overall "plan" that the Commission was to devise, enshrined the rule of rate-making (fair return on a fair value) into law and gave the Commission control over security issues and service.

In general the idea was to rationalize, definitely *not* nationalize, the system and abandon the emphasis upon competition among railroads and between them and the rapidly emerging truck and bus industries. Inter- and intra-modal coordination was the new fetish probably inspired by the credible job done by the Railroad Administration during the war and the equally new fetish from which coordination derived, namely "scientific management." Even Joseph Eastman, soon to become an ICC commissioner and destined to be its greatest, approved of both extension and nationalization. But it was not to be. The *Transportation Act of 1920* hoped that private ownership and operation under the "inspired" leadership of the ICC would yield most of the advantages of nationalization without the disadvantages.

This was not to be either. The Commission was reluctant to exert any leadership and refused to formulate a formal plan for railroad reorganization ostensibly to eliminate the so-called weak-strong road problem. The ICC even begged to be relieved of the task of bothering to concoct any plan. The Commission did not "free the industry . . . of the accumulated burdens of past ills . . . [nor] establish principles and practices for this regulated industry beyond and above those recognized in the general competitive field."[30] Nor did the Commission urge the railroads to reduce bonded indebtedness or to consolidate into fewer more economically viable systems. This meant that when the Great Depression began, the industry suffered far more from reduced business than would otherwise have been the case, and the Commission, regardless of its legal authority or of any infusion of leadership zeal not hitherto apparent, was totally unable to help out under such overwhelming economic forces.

## Conclusion

On the eve of the Great Depression, the U.S. possessed a substantial rail system that was heavily concentrated in the east and sparse but adequate in the west and much in between. The mileage had already begun to shrink to eliminate much redundancy in particular parts due mostly to the frenzied over-building especially between 1893 and 1920. The beginnings of an increasingly ubiquitous highway system had been well established which hastened the rail redundancy. Passengers had growing options for intercity movement in many parts of the country but especially the eastern section. The rail monopoly had been effectively broken and was never to be regained in either passenger or freight business although this was not recognized at the time.

The railroads, for the most part, supported the alternative highway mode on the assumption, often stated, that the new service using highways could never be anything but ancillary or "feeders" to rail connections for ongoing journeys or goods shipments. It would also relieve railroads of the short trip or haul which was the less profitable phase of the business anyway. By so doing, trucks and buses and even private automobiles should be encouraged for reasons of profitability as well. Further highway construction and the industries producing the vehicles would add to rail traffic as the raw materials and finished products would inevitably be shipped by rail, except for the minor exceptions in a few parts of the nation where waterways might be used. The stimulus to overall goods production and incomes generated by the new mode and its infrastructure would also raise the growth rate of GNP which would further stimulate railroad traffic.

Thus instead of opposing the new mode, the railroads supported it, at least in a broad, general sense. They even invested somewhat in bus transport to serve light-density areas without branch lines or to permit branch line abandonment in many cases. The Pennsylvania railroad helped create the Greyhound network, and other railroads owned part of the National Trailways bus system. By 1941, rail interests are reported to have owned 1,759 buses serving 44,700 miles of route.[31] Railroads invested very little in the trucking industry and viewed it as even less of a threat. It is hard to see this as especially short-sighted from the vantage point of the late 1920s. Air travel was certainly no rival yet and the highways, pipelines and waterways had not yet made such inroads as could topple the mighty railroads from their pre-eminence. Besides traffic was growing rapidly during the Roaring Twenties so there was plenty to go around even if one's relative share was shrinking. On the other hand, rail short-sightedness was monumental by virtue of hindsight. Had they taken over the short-haul trucking or bus businesses to a far greater extent, which was then feasible, they would have received grandfather rights in the less likely event that highway service would have been regulated. In either case, the extent of modal integration might have been far greater than became the case in the U.S.

Failure to enter more fully into bus and truck transport also supported development of independent truck and bus operations which heightened the emphasis upon modal separation despite all the stress that came to be put on coordination and integration. This is all speculative, of course, but is one of the "if only" myths as noted in "Icons and Albatrosses."[32] It should also be remarked that any major entry of railroads into truck or bus transport might well have led to several massive multimodal oligopolies whose contributions to efficient resource allocation by mode might well have thwarted developments in truck and bus transport. Intra-firm efficiency might have left much to be desired by such large multimodal enterprises whose (largely railroad) experience and sympathies, to say nothing of relative investment commitments, might have had strong negative effects.

## THE POLICY OF MODAL SEPARATION

The reticence of rail companies to enter into truck or bus operations extensively or to acquire large numbers of existing enterprises in highway transportation combined with the national fear of excessive railway concentration of economic power, already enormous before 1887, led to legal and regulatory restrictions against multimodal companies or what later came to be called integrated transportation firms. As early as 1912, long before highway modes were anything more than a distant possibility, the *Panama Canal Act* was passed forbidding railroads from operating or having any interest in water carriers using the Panama Canal without specific ICC approval. The fear was that such ownership would restrict the development of intercoastal water traffic via the Panama Canal to protect the rail monopoly over the coast-to-coast traffic by land.

Similar beliefs arose during the 1930s with respect to rail acquisition of trucks and buses. The *Motor Carrier Act of 1935* sought to preserve the "inherent advantages" of motor carriers, a corollary of which required that any motor carrier acquired by a railroad must be used "to public advantage in its operations." This was promptly interpreted by the Commission as obligating the railroad to operate the motor carrier entirely as an adjunct to its train service.[33] Congressional intent was to prevent the acquisition of control of motor carriers so that it not "get into the hands of other competing forms of transportation who might use the control as a means to strangle, curtail or hinder progress in highway transportation for the benefit of other competing transportation."[34] There was, in short, concern that the railroads would acquire other modes solely to protect their own much greater investments in rail facilities. It was feared they would stifle developments of other modes except as small-scale contributors to rail operations and would perpetuate rail monopoly power and profits. There was little recognition that a multimodal enterprise could contribute to overall efficiency or that in many respects the modes were complementary rather than competitive. Thus the tradition and even policy of modal separation in the U.S. persisted until the early 1980s, well after the deregulation movement had taken place.

This is all the more surprising since enthusiastic support for the integrated transport firm selling transportation by rail, truck, bus, water or any other mode presumably using the least-cost combination for any shipment or travel, began early in publications by H. G. Moulton and The Brookings Institution.[35] These were reiterated later. For example, the Doyle Report (1961) flatly stated that "there should be no prohibition in the law against the formation of . . . a transportation company . . . a carrier of any mode [should be allowed] to become part of such a transportation company."[36] In 1979 the National Transportation Policy Study Commission recommended the elimination of "Federal impediments to common ownership and intermodal coordination and cooperation," and the promotion of "effective joint rates and through service within and among modes."[37]

Despite removal of most formal restrictions against intermodal operations and ownership, there are few examples in the U.S. today of large multimodal enterprises and nothing analogous to each of Canada's two major railroads owning and operating large national trucking companies. Indeed, in Canada, multimodalism has a long history with the CPR chartering ships to carry traffic on the Pacific Ocean in 1886, inaugurating passenger service there in 1891, passenger and cargo services on the Atlantic in 1905, and later truck and airline services as well. The MacPherson Commission found rail ownership and operation of trucking services in Canada consistent with efficiency and saw "no reason to limit the entrance of railway companies into any other mode of transport. The experience of other countries with such restrictions does not encourage us to recommend it to Canada."[38] So much for the U.S. position on modal separation!

The more or less naive U.S. position on modal separation, is believed to have retarded the growth of piggyback (TOFC [Trailer on Flat Car] and COFC [Container on Flat Car]) operations in the U.S. as compared with Canada and otherwise to have impeded efficiency achieveable from greater modal integration. On the other hand, at least at the beginning, the belief that the railroads might have misused or wasted, from the social point of view, any large-scale investments in truck or bus operations was not so far-fetched as it seems.

Since rail intercity passenger traffic had not accounted for much over 10 percent of total rail revenues during the 1920s and an even smaller proportion of profits, in the face of a sharp downturn in number of passengers and passenger-miles, it is difficult to see why railways continued to stress investments in and general support of this segment of the business. Certainly, the ICC did little to require continuance of unprofitable service even after being given what has been referred to as "sweeping" powers over abandonments. Indeed, the Commission "Guided primarily by financial considerations . . . generally approved abandonments."[39] Maybe there was something to the "image" in the sense that despite lower profitability, perhaps some railroads felt that the prestige of grandiose terminals, the luxury side of passenger travel that provided association of the railroad executives with the rich and the famous in America was worth the expense. At least it suggests that railroads would have been unlikely to stress development in truck or bus subsidiaries had they chosen to move vigorously into these areas during the 1920s when the opportunity presented itself.

For the latter 1920s the railways were still profitable, possessed much monopoly power in numerous freight and passenger markets and were still the giants of U.S. enterprise. After return to private ownership and the other features of the *Transportation Act of 1920*, they were expected to remain so. The Act further enhanced the powers of the ICC to prevent "cut-throat" competition, sustained collective pricing agreements (i.e. rate bureaus) contrary to the antitrust laws, facilitated abandonment of unprofitable service and otherwise benefitted the railways under the new so-called "positive" approach to regulation. The latter involved helping resolve the "weak-strong line problem," stimulating mergers between profitable and less profitable or losing railroads and, in fact, aiding in the accomplishment of the new rule of rate-making which sought to ensure to each carrier, as a kind of *quid pro quo* for being subject to regulatory "restraint" and more or less ignoring the benefits of past public *largesse*, a "fair return on a fair value" of the property devoted to provision of rail transportation service. This, of course, meant enormous profits or yields on assets of dubious value for an aggressive and lucky few in the likely event that the Commission failed to develop a sensible plan of railroad consolidation.

All of this was speculation. In less than a year of the close of the decade of the 1920s, the economic and, indeed, social and political world of the U.S. and almost everywhere else was suddenly and irrevocably changed beyond all belief. No one foresaw the Great Depression, least of all economists or governments.

# 3. THE GREAT DEPRESSION

The 30 percent contraction of real GNP from 1929 to the trough in 1932-33 was the most severe to beset the U.S. economy before or since. It was also the longest, with the level of economic activity remaining persistently below that achieved in 1929 for 10 years and longer than that in terms of GNP per capita. The reasons for the severity and duration are not yet altogether clear. From the U.S. point of view, however, what would doubtless have been a more or less routine contraction in 1929 was turned into a rout probably because of three major macroeconomic policy errors that it is hoped will never recur. In the first place Congress passed the Smoot-Hawley protective tariff Act in 1930, which understandably led to sharp retaliation from the U.S. trading partners. Such "beggar-thy-neighbour" policies succeeded in shriveling up much international trade including, of course, U.S. exports. Second, The Federal Reserve System allowed the money supply to shrink by about 30 percent which kept real interest rates too high and promoted financial panic. Third, the income tax rate was increased in 1932 to balance the budget. This reduced disposable incomes and contributed to the decline in personal consumption expenditures, the single biggest component of GNP.

Whatever the causes of the excessive severity of the depression beyond the probable "normal" cyclicality of market systems, the results for the railways were devastating. Passenger traffic dropped by almost 50 percent between 1929 and 1933 while passenger revenues collapsed by about two thirds. Freight performance was almost as bad. Despite declining operating expenses, net income fell from a positive $977 million for all roads in 1929 to a negative $122 million in 1932. It remained extremely low for most of the 1930s and only exceeded the 1929 level in 1942 during the wartime boom. Bankruptcies rose during the depression despite generous government aid and in 1939 included almost one third of the total rail mileage. Passenger deficits began in earnest and were the main reason for the overall deficits and minuscule net revenues. Starting with modest negative earnings in 1930, the passenger deficit rose to the $250 million range during the years 1938 through 1941 and constituted some 30 percent of net revenues from freight traffic on average until 1941.

However, while rail executives believed that the dismal passenger performance through 1933 was largely due to the depression, total intercity passenger travel had only decreased about 20 percent since 1929 compared with 50 percent for rails. In fact railroads suffered more than any other mode in extent of decline of business,[40] as was pointed out by Joseph B. Eastman, the Federal Coordinator, a post created by the *Emergency Transportation Act of 1933.*[41] His Report also asserted that, important as the depression was, "Flight of passenger traffic from the railways is due to failure to keep pace with modern methods of marketing, servicing, pricing and selling."[42] The railroads were lacking in "personal helpfulness," depots and terminals had been designed mainly for "operating convenience" rather than "passenger convenience," marketing policy among the railroads was competitive rather than coordinated. The entire attitude of rail personnel from management down was obsolete and needed radical change if the "great opportunities for the reestablishment of railway passenger service upon a profitable basis" were to be seized. Such opportunities were believed to exist because the growth of automobile traffic "indicates the volume possibilities which await a still more attractive and economical mode of travel."[43]

Many other suggestions for reform were made in the Report of the then powerful Federal Coordinator. However, as has been pointed out, "rail executives resorted instead to 'flash' over substantive reform and hoped that their problems would go away."[44] The new strategy was called "streamlining" and involved development of extraordinary passenger trains such as the Union Pacific's M-10,000, and the Burlington Road's *Zephyr* which captured the public's imagination at the Century of Progress Exposition in Chicago in the summer of 1934. Movies were made of the new trains and a new streamline craze became for a while attached to numerous types of product.[45] For a short time, the downward trend in rail traffic was arrested. Both the number of passengers and especially passenger-miles rose from the depths of 1933 by 15 and 52 percent respectively through 1937. However, traffic dropped off again until the brief wartime revival then resumed a continuous decline through 1970 before the creation of Amtrak. "While the success of the streamliners provided reason for optimism, all was not well in the railroad passenger business."[46] Indeed, passenger deficits stayed high through 1941 despite the traffic gain and resumed their upward spurt after 1945. More needed to be done along the lines recommended by the *Passenger Traffic Report.* By the time the railroads realized this, it was already too late.

On the other hand, there were more positive aspects for rail rivals largely because, in seeking to moderate the depression, the federal government embarked on massive, expenditures many of which went for transport infrastructure in highways and airways. In fact, the quality and quantity of the highway system were considerably improved by World War II over what had been its state at the start of the decade. Air transport also received a big boost not only from direct subsidies but from development of the airways and airport systems as well during the depression. Thus two of the railroads' leading rivals received right-of-way expansions that made their future inroads upon rail traffic far more potentially severe and certainly much earlier than would otherwise have been the case. Buses and private cars siphoned off rail passengers especially for short-haul traffic while airlines were preparing themselves, also at public expense, for attacking the long-haul passenger business. Truck traffic was to capture increasing amounts of the freight business but more important, the higher rated and valued traffic was rendered more susceptible to such "theft" by the railroads' misapplication of value-of-service pricing. That is, freight rates and some passenger fares were kept further above marginal costs than demand elasticities warranted especially when the latter increased as inter-carrier competition grew.

Thus the general rail advantage of lower marginal or variable costs was often dissipated by excessive and not necessarily profit-maximizing mark-ups over a specific unit cost, itself over-estimated by inclusion of arbitrary amounts not related to avoidable costs but rather arbitrary accounting allocations. In short, the railway pricing system at the time was crude to say the least — a by-product of monopoly power and general lack of competition and marketing savvy as well as inadequate knowledge of specific avoidable costs. A large number of rates, perhaps as many as 30 percent were, even in a later and more enlightened era, found to be below the ICC version of actual variable costs! Many more were excessively high in terms of maximizing the net revenues or net profits. The rate structure made little economic or financial sense.

The arrival of new competitors on the scene, with not only different costs but generally superior quality, meant that without significant reductions in particularly high rates, far more traffic would be lost than was either necessary or, from a social point of view, efficient. Below cost rates needed to be raised. Clearly the "preservation of inherent advantages" of each mode, required by the 1940 Act, could only take place under a regime where specific rates and fares reflected correctly the underlying marginal costs and the specific demand elasticities. Some mark-ups over costs were needed to finance the many joint, fixed or otherwise indivisible costs so characteristic of railway operations. This was, of course, too much to expect during the era of rail monopoly when the rate and fare structure was established. The incentive to create an economically rational structure did not exist. Nor, it should be noted, did the techniques. The period of deep depression followed by the war-induced traffic boom failed to provide incentives to price rail services correctly either even if efficiency had been the goal. Only after these overwhelming events could rational traffic allocation via efficient pricing have a chance to succeed.

The attempt to achieve allocative efficiency by *extending* the scope of regulation to all modes and providing the ICC and CAB with far reaching powers was not shown to be fruitless and enormously costly until after the late 1940s. Thus, in a major sense, the Great Depression provided fertile soil for the "grand experiment" or what I have called elsewhere "the grand Benthamite design"[47] involving detailed regulation of all modes and most aspects of transportation under private ownership. The failure of this experiment engendered the reformist zeal of the late 1950s. The depression itself represented an enormous failure of the market system, even if its severity and duration had other contributing factors. Certainly it discredited much faith in reliance upon market forces to tolerate a disaster of this magnitude. In this sense, the experiment in attempting to modify or negate market forces was induced by the depression. The form it took in the U.S., namely development of what came to be called the "fourth branch of government," (see below) was relatively benign when compared with the more radical experiments with central planning, widespread nationalization and the like elsewhere.

But in the bastion of free enterprise, private property capitalism and democracy, it was not clear what should or could be done. The response in transportation was essentially more of the same. It was argued that the ICC failed earlier because it did not have enough authority and jurisdiction over all modes especially with the rapid growth of bus, truck and automobile traffic stimulated by the burgeoning highways. The quality of the Commissioners and staff was likewise not adequate. Since reliance on market forces seemed out of the question in the circumstances of the depression, it seemed logical to remedy these defects by legislative and personnel changes. After such measures, the ICC could reduce the reliance upon competition, regulate entry and exit, determine mergers, set rates and fares, monitor investments and financial arrangements of the carriers, specify accounting practices and so on in an effective fashion. In short, it could coerce or induce the modes to behave like a more effective cartel that provided many social-type services, such as special rates for agricultural produce, low passenger fares for the poor, service even at a loss to outlying communities without alternative means of access, and so on. These services could be financed by cross subsidy from profit-maximizing rates and fares on other traffic. Overall profits could be limited to some reasonable amount to retain an aura of respectability and attract additional private capital when needed. The whole procedure would impart a degree of stability, permanence and, it was hoped, adequate level of service that would keep costs low and passengers and most shippers happy.

Transportation is tailor-made for this type of regulation. Each firm is a multi-product enterprise. Railroads produce not only passenger service and freight but within these categories the shipments of each commodity and travel of each passenger class between each pair of points or origins and destinations, can be viewed as a separate submarket having its own more or less specifically assignable costs and demand function. The game is to decide which services should be provided at below or close to avoidable cost, for whatever public purpose seems relevant at the time. All other prices would be set to achieve enough profit in the aggregate over and above these losses or reductions in net revenue to yield a fair, normal or otherwise "reasonable" rate of return on the total assets devoted to transport.

This is a system of discrimination designed to accomplish selective social and economic purposes at least cost. Private ownership and operation are believed to ensure the latter while economic regulation implements the social purposes responsive to Congress which creates the agency, determines its objectives and often its *modus vivendi* as well.

As noted, transportation is a natural since it has all but one of the ingredients necessary for effective price discrimination, namely, markets that are readily separable and demand elasticities that differ substantially in each submarket. For example, rate differences unrelated to the costs of transport can exist for different commodities because shippers cannot convert a high rated good (say, finished automobiles or diamonds) into a low rated good (say coal) to take advantage of the lower rate. Thus, freight classification systems early emerged in rail transport with rates applying to what was being shipped. It did not have to be this way. Shippers could have offered packages of "things" to be transported and have rates based strictly on weight and distance without concern for the contents of the containers (i.e. the specific commodities involved). Indeed there are some so-called FAK (freight all kinds) rates and there is now much containerized shipping. But rate structures developed around classes of commodities often finely distinguished because this was far more profitable since it permitted more extensive discrimination. Thus, rates are based upon commodities (their values, shipping characteristics such as density, fragility, etc.) and specific origins and destinations, thereby permitting a vast array of different mark-ups over cost. For each such movement there will be an elasticity of transport demand that depends upon the product of the elasticity of demand for the commodity in any particular market and the ratio of the freight rate to the delivered value of the commodity. Since commodity demand elasticities vary sharply, not only among commodities and in particular markets but also over time, and freight ratios do likewise, it is clear that *transport* demand elasticities are also highly variable and differ among the various submarkets. This permits substantial price discrimination or large differences in the mark-ups over computed marginal costs.

There is more to the story but the main point is that for suppliers of transportation services the opportunity to discriminate and hence become more profitable is uniquely available compared with most other producers. In addition, it can be argued that railways have more incentive to discriminate because of their cost structure and behaviour but that is yet another story.[48]

However, the foregoing suggests that only two of the three preconditions for successful price discrimination naturally exist in transportation. The third is the requirement of some degree of monopoly power. Without the ability to prevent entry of rivals in any market, it will not generally be possible to maintain a rate or price much above marginal or out-of-pocket cost without formal collusion. In this sense competition is said to be the great leveller. It forces all prices toward the marginal costs of the least-cost producer and precludes much discrimination. Although rails at one time had a large degree of monopoly power in numerous submarkets which permitted them to develop an elaborate classification system, this began to crumble and was extensively undercut by the development of bus and air passenger alternatives and especially trucks which could pick away at the upper end of the rate structure earlier put in place.

Maintenance of the discriminatory system in the face of growing shipper and traveller options, required that the common carrier segment of transportation be provided with monopoly power wherever possible through regulation or protected from freedom of entry into the high-yield submarkets. Thus regulation had to be tightened in the late 1920s and especially the 1930s to prevent the destruction of such discrimination. Regulatory policies restricting new entry into particular markets, specification of *minimum* rates and fares and other efforts designed to restrain competition were needed, not to protect the public as often believed, but rather to protect the carriers and especially the *system*. This would allow the implementation of a wide variety of social and other purposes unrelated to efficiency of production or allocative efficiency among modes or carriers. Regulation, if successful, would permit substantial mark-ups over cost in some submarkets that would provide higher net revenues. These in turn would allow much lower, and even below cost, rates and fares in other submarkets to effectuate some predetermined "social" or special purpose while maintaining private ownership and operation since overall revenues could, it was hoped, be made to exceed total costs by amounts yielding fair or normal rates of profit. Thus, cross subsidy in the absence of competition through regulation came to prevail in rail transportation and was even sought to be applied to bus, truck, air and inland waterway transportation.

The depression raised serious doubts about the efficacy of a policy based on competition and market forces. Indeed it is surprising that, with all the excess capacity resulting from the collapse of production and incomes, more cartel-like arrangements along the lines of the *National Industrial Recovery Act* codes of "fair" competition were not established. More surprising is that overtly socialist or communist measures involving widespread nationalization or more radical changes in the U.S. economy were not attempted. As it turned out, commission-type economic regulation was expanded within transportation and in various other areas as well. In fact the 1930s became the hey-day of the regulatory commission despite the dismal show put on by the ICC earlier. So strongly was there a perceived need to extend regulation that it was rationalized in terms of what was referred to as the "fourth" branch of government, alongside the executive, legislative and judicial. In a real sense, extended regulation was the U.S. alternative to socialism, communism and more detailed central economic planning at the microeconomic level. Keynesian economics later turned out to be the alternative at the macroeconomic level. The former failed long before the latter although this was not recognized, nor were the linkages between the two appreciated until later in the 1970s.

So important are the 1930s in the evolution of United States transportation infrastructure and policy, that the changes that took place then and their cumulative effects became the focus of the attacks in favour of market forces of the 1960s. The remainder of this section will examine briefly the road to more effective cartelization and further retreat from efficiency criteria.

## TRANSPORTATION INFRASTRUCTURE

The big change in infrastructure policy relates to the highways. The policy had been one in which limited federal aid was given to the states for predetermined roads and in amounts strictly limited by federal budgets. The states and local communities were expected to finance the bulk of total construction costs and all of the maintenance costs. There were even questions regarding the constitutionality of any federal aid to highways, a viewpoint that dates back at least to the days of Presidents Monroe and Jackson. Yet the logic of increased federal participation was inexorable. Without federal aid there could have been no national system of interstate highways, such as now exists, although even such a system was questioned as late as the 1950s and failed to pass Congress until President Eisenhower referred to it as the national system of interstate and *defence* highways. Beyond defence, the federal government also has a duty to promote the free flow of interstate commerce which virtually cried out for increased participation in the slowly evolving road system.

All this timidity concerning federal aid changed with the Great Depression. Federal caution on highway spending was abandoned. The economy had to be stimulated no matter what. Since this required increased spending, it seemed prudent to focus on something useful rather than strictly make-work projects. Throughout the 1930s, therefore, highway expenditures were part of the strategy to promote economic recovery. Federal aid was extended well beyond the confines envisaged by the highway Acts of 1916 and 1921. By 1936 the Chief of the Bureau of Public Roads could report about the previous three years that "all highway construction was administered with employment of those on relief rolls as the primary objective."[49] This enormous change in policy involved a massive increase in federal outlays for roads, which rose from barely $94 million in 1930 to over $1,170 million during 1939. Some 80 percent of the total in 1939 consisted of special federal relief program outlays. By the end of the 1930s state and local governments supplied fewer funds for construction than they had at the beginning. The former relationship among federal, state and local governments, so painstakingly developed since 1916, had been thoroughly transformed as had the motivation for highway expansion. As a result, the nation emerged from the Great Depression with a vastly enlarged and improved highway infrastructure.

With this infrastructure, a thriving truck and bus industry arose. Our concern is not directly with the trucking industry except to the extent that it sharply reduced the ability of the railroads to continue subsidizing intercity rail passenger traffic to the point where they ultimately required relief which much later took the form of Amtrak and public subsidy. Competition from intercity bus lines and of course vigorous growth, even during recession, of private automobile travel made further inroads on the railways.

The trucking industry had another influence upon bus service since regulation of trucking was virtually demanded by the railroads after they became aware of the magnitude of the threat. Other interest groups, including the larger trucking companies, also demanded trucking regulation, complaining about excessive competition from irresponsible individual truckers who drove unsafe vehicles, were uninsured and otherwise reprehensible. Indeed, the trucking industry became a kind of "haven for the unemployed" who entered the industry in huge numbers buying some kind of vehicle on vendor credit, as a stopgap until other job prospects emerged. Such marginal operators were willing to carry any and all freight at rates down to or below out-of-pocket costs plus a limited amount for their own subsistence. The poor service and financial weaknesses of such operators did nothing to improve the shippers' image of the industry and gave even stable companies a bad name, reducing earnings to boot. Support for regulation of the trucking industry grew. Even an industry that possessed most of the technical features of being highly competitive was grist for the regulatory mill ostensibly to permit closer coordination and reduce the wastes of competition and instability.

On the other hand, the bus industry had achieved a high degree of stability by the mid-1930s possibly because of relatively greater railway involvement in helping create the large Greyhound system and somewhat more careful state regulation because of the safety issue than applied to independent trucking. Most states sought to regulate bus transport as a public utility and reduced competition and new entry on many routes. Regardless of the differences, the attempt to provide the ICC with expanded powers to implement the "grand regulatory design" noted earlier, swept up both truck and bus transportation within the same legislation, examined in the following section. Suffice it to note here that the new highway infrastructure along with the previous and continuing advances in vehicle motive power, design, safety, speed dependability and comfort, utterly transformed the competitive and institutional structure of transportation in the U.S. Despite this transformation, the regulatory regime imposed was based upon the 1887 *Act to Regulate Commerce* and failed to recognize the structural differences between railroads on the one hand and bus, truck and air transport on the other.

Airline infrastructure also gave rise to virtually a whole new industry which now dominates the commercial provision of intercity passenger traffic. Unlike with rail and highways, the provision, operation and maintenance of the airway system are a function of the federal government and have been since the beginning. In the 1920s the U.S. Army engaged in aerial map-making and airmail experiments in conjunction with the Post Office. Congressional appropriations financed a system of radios throughout the country and developed a night airway system coast to coast before the end of 1926. The *Air Commerce Act* placed responsibility in the Department of Commerce to foster air transportation, developing and establishing of airports, civil airways and other navigational facilities. Responsibility was again transferred under the *Civil Aeronautics Act of 1938* which began the direct economic regulation of the airlines as well. The airways remain a responsibility of the federal government and subject to annual appropriations plus, more recently, receipts from airway trust funds analogous to the highway trust fund established earlier.

Airports are also publicly owned but usually by local or regional "port authorities." Although prohibited from building airports, the federal government nonetheless made funds available during the Great Depression from various public works and Works Progress Administration programs. Thereafter the *Civil Aeronautics Act of 1938* created a plan of regular federal participation which accelerated after World War II. Suffice it to note here that the infrastructure of this future strong competitor with rail long-distance travel received substantial federal assistance from the beginning including, in the early days, direct mail pay subsidies for airline operations and, of course, enormous support in developing airplanes and preparing them for the transition from military to civilian and commercial.

Airline passenger growth was very rapid in the 1920s and continued throughout the Great Depression. By 1930 the number of airline company passengers had risen to 383,000 from 48,000 in 1928. The number passed one million in 1938 and reached about four million in 1941 before the war curtailed civilian travel.[50] Rail passengers averaged over 450 million during the 1950s[51] so quantitatively the impact was insignificant. Qualitatively, the picture was different and became far more so after World War II.

Finally it should be noted that while road and air transport infrastructure and its use had expanded enormously, that of rail shrank both in mileage, mostly of branch line abandonment, and certainly in use. The latter was only temporary as World War II was to change all that if only for what was to be a fleeting interlude.

## TRANSPORTATION POLICY

With the tremendous increase in transportation capacity in all modes due to the severity of the decline in aggregate demand, and government investments in non-rail infrastructure, public policy concerned itself with preventing further price declines and in fact trying to engineer price increases to prevent profitability from disappearing altogether. This is understandable since macroeconomic policy was then unheard of. In fact this approach had at least one element of macro policy, namely, that if profitability could be restored, private investment might be stimulated which would expand output and also employment. The inconsistency here was not perceived. Why would firms, even if restored to profitability by price increases, expand capacity when there was already too much of it and how could the prices be maintained in the face of increased output? However, the prevailing philosophy was that competition was excessive and had to be carefully controlled. This required extensive expansion of regulatory powers in those industries already regulated, namely, transportation under the ICC and power under the Federal Power Commission, and extension of regulation to other industries as well as pushing the NIRA codes of "fair" competition everywhere else as part of President Roosevelt's New Deal program.

Even before the depression, people had been encouraged by the effects of business-government cooperation during World War I and especially the Railroad Administration's success at unravelling the congestion and improving coordination among the carriers. The era of "scientific" management had already arrived. In addition, Thorstein Veblen's emphasis upon giving power to engineers to run the industrial plant in the interests of physical coordination, production of "serviceable" products and efficiency, a form of technocracy, rather than businessmen seeking profits, created something of a stir, as did Veblen himself.[52] The point is that the reaction against markets not only took the form of reemphasis upon regulation and its extension but on the importance of "experts" on the regulatory commissions who had intimate knowledge of the industry just as engineers would know more about production than businessmen. Furthermore, since the regulatory goals of the firms would not be maximum money profits, production decisions would be less concerned with mere pecuniary values than with producing real, tangible commodities that were serviceable. The expert-dominated commission became the ideal. Commission-type authorities spread beyond transportation and power to other areas and included the Securities and Exchange Commission, the Federal Communications Commission and the National Labor Relations Board.

As noted, these sentiments predated the Great Depression but were vastly enhanced by it in attempts to protect business from unprecedented overcapacity. "The same premises that underlay the Keynesian revolution in macroeconomics — that government should take a hand, that expert public servants were more likely than business executives to choose the wise course — also applied to microeconomic regulation."[53]

The arguments in favour of regulation and especially industry-specific regulation by a small group of people with special knowledge or expertise about the industry were not only economic — that is, justified by market failure, economies of scale, the so-called "wastes" of competition, natural monopoly, large-cost indivisibilities necessitating discriminatory pricing, the need to promote the industry and the like — but also political.[54] The extension of regulatory authority was rationalized in terms of need, inevitability and legitimacy — the "fourth" branch of government. While the role of government in an industrialized economy must increase, the existing branches of government — legislative, executive and judicial — were not designed to cope with it and its drive toward monopoly power and general cyclical instability. The rise of a specialized administrative branch was therefore a logical next step in a political democracy. The general argument is not unlike that used by Japan to justify and rationalize the activities of the Ministry of International Trade and Industry (MITI). Indeed the kind of "guided capitalism" in the form of industrial policy that MITI exemplified in its early decades closely parallels that of the "grand design."

## REGULATORY EXPANSION

The ICC, after acquiring additional authority from the *Transportation Act of 1920*, sought to extend it even further as the motor carrier threat loomed larger. It was not however until 1935 that the *Motor Carrier Act* was passed which extended the Commission's authority to regulate the trucking industry. The Act became part II of the *Interstate Commerce Act*. It had been strongly supported by the Commission, the Federal Coordinator of Transportation, the railroads and the larger organized trucking firms, but opposition from motor vehicle manufacturers, shippers and small truckers fearing that regulation would restrict the industry in favour of railroads held it up for many years even after the depression was well under way. Most economists opposed it on grounds that the motor carrier industry was about as far from a natural monopoly as could be conceived. Entry was easy, fixed costs were low, vehicles could readily be shifted to accommodate traffic flows and adjusted to total business, no scale economies were evident, and so on. But the economists' hour had not yet come. The grand design needed to be tried. So the Commission took under its wing an industry almost the complete opposite of the railroads.

The ICC's workload burgeoned. By November 1, 1936, there were some 86,000 applications for certificates and permits, one half of which were protested; over 53,000 tariff publications; almost 17,000 schedules and 2,000 contracts filed. The Commission was swamped. In addition the Act required fine distinctions to be made among common, contract, exempt and private carriage, what constituted an "agricultural product" since these were exempted from regulation, and so on. More important, the Commission had to determine what the "inherent advantages" were of truck vis-à-vis rail and how to "preserve" them.

As if this were not enough, the *Transportation Act of 1940* gave an already swamped and confused Commission jurisdiction over coastwise, intercoastal, inland and Great Lakes common and contract water carriers in interstate and foreign commerce! All of this and more was bestowed under the statement of national transportation policy noted in Section I and also noted for its ambiguity, inconsistency and requirement to meet the "needs of commerce, of the Postal Service and of the national defense."

There was some discussion about placing air transport under the ICC's jurisdiction as well but a certain amount of common sense prevailed and consistent with the regulatory mania, a new commission, the Civil Aeronautics Authority, (later Civil Aeronautics Board) was created in 1938.

By 1940 therefore the ICC had been granted abundant authority to rationalize or coordinate the several modes of transportation, except for air, and including both freight and passenger transportation without distinguishing between them. The Commission had been powerless to do anything in the face of the depression. It certainly could not guarantee rail profitability, the rule of rate-making notwithstanding, and was unable to obtain much in the way of inter-railroad coordination or cooperation either even under those critical circumstances. It was now enjoined to seek rail-truck-bus-water, etc. integration. During the 1920s, the ICC had performed dismally. Having failed to lead for over 20 years, the future did not look propitious no matter what authority the agency possessed. The "grand design" for an important segment of the newly rationalized "fourth" branch of government did not appear to be in very good hands unless some more enlightened and energetic commissioners could be found.

The outlook for the newly formed CAA was more propitious if only because it seemed to start with a blank slate and fresh faces. However, the principles expressed in the new Act were like those of the *Act to Regulate Commerce* of 1887 and the recently passed *Motor Carrier Act*, namely "the usual system of economic regulation" as the Senate Committee on Commerce explained. This meant that the industry was to be treated as a public utility currently subject to excessive instability, cut-throat competition, inadequate earnings and the usual excuses for bringing regulation to bear. In this case of course, as with rail, trucking and the bus industries, the major problem was the Great Depression. Few industries or even firms outside of transportation fared very well nor could be expected to do so in the presence of enormous excess capacity. What is not so evident, is the degree of undesirable instability that might have occurred in more prosperous and less unusual and turbulent times. However, when recovery came about there was ample opportunity to test the feasibility of the regulatory regimes put in place in transportation. This was to come after World War II.

# 4. WORLD WAR II TO THE TRANSPORTATION ACT OF 1958

Massive increases in federal government expenditures, mostly in preparation for the war then raging in Western Europe, occurred in 1939 and accelerated rapidly following U.S. entry into the war after December 7, 1941. This was the stimulus the economy needed. Real GNP surged by almost 8% per year during 1939 and 1940 and by 18% per year through 1944 — incredible growth rates by contemporary or indeed any standards. Such growth of course was possible because of the enormous excess capacity during the depression. The unemployment rate fell from a whopping 25% during 1933 to less than 5% in 1942 and below 2% for the next three years. It was as if the country were a coiled spring waiting for some catalyst to let it loose. The war did so with a vengeance.

Such dynamism had enormous impacts on almost all aspects of the economy and society but few more dramatic and positive than on railroads. On the verge of almost total financial collapse in 1938, rail tonnage and revenue records were broken during 1942, 1943 and 1944. Passenger revenues hit an all-time high in 1944 and the passenger deficits turned into substantial surpluses during 1943, 1944 and 1945. Railroads carried "97 percent of troops and 90 percent of army and navy supplies moved within the United States."[55] The railroads were indeed riding high. Part of this was, however, due to curtailment of competition. Because of fuel and equipment shortages, truck and private car travel was sharply curtailed. Bus traffic increased somewhat but civilian air travel was virtually eliminated. No wonder the public, industry and the military flocked to the railroads who literally never had it so good.

The euphoria for the railroads was short lived. The end of the war meant an end to massive troop and armaments movements. The dismal passenger service was well remembered by those subject to it during the war and when restrictions on air and automotive travel were removed and production of new and improved planes and cars began, people and freight left the rails in droves. The long steady relative freight decline resumed with the rail share of total ton-miles falling from 62 percent in 1939 to 49 percent by 1956 and continuing thereafter.

Even more dramatic was the resumption of the *absolute* decline in passenger traffic. Almost monotonically, passenger-miles fell from 95 billion at the wartime peak in 1944 to barely 23 billion in 1958, with a further steady decline to less than 11 billion in 1970, the year before Amtrak. The number of passengers fell almost as dramatically. More significantly, rail passenger traffic became minuscule in proportion to total intercity passenger-miles, including private automobiles, falling below four percent and a diminishing share of common carriage already down to less than a third by 1958. The war years were but a brief upward blip, a mere interlude, in the long-range decline of both rail freight and especially passenger traffic.

More significant for the railways were the burgeoning passenger deficits which reached alarming highs of over $700 million by 1957. Despite more or less valiant efforts of the railways to employ more sophisticated and better equipment and upgrade service quality, they were no match for the service quality-cost alternatives provided by automobiles and airplanes, assisted to be sure by a public sector prone to concentrate large amounts of resources steadily into improvements in their respective rights-of-way. Intercity rail passenger service seemed doomed to chronic unprofitability.

The railroads did give the passenger business a decent try in the post-war period, much better and more sustained than the "streamliner" gimmick of 1934. But the passenger business is different from freight, and since it was producing negative net receipts while freight traffic was at least somewhat profitable, and since passenger traffic had traditionally been viewed as a by-product, often expensive but occasionally exotic in some aspects of its service, there was little more that could have been expected from rail management. There is no evidence of deliberate downgrading of service to induce customers to stay away because until 1958 there was no certainty that states, which had sole authority over discontinuance, would permit abandonment. In fact there was much evidence to the contrary.

However there came a point after which, despite some real efforts by management to change the cost-quality options, the profit prospects seemed hopeless. The Hosmer Report, examined below, also concluded that the passenger decline could not be attributed to rail management hostility or indifference, arguing that in fact they had made a "noble" effort to preserve the service out of pride and public obligation, but that even a marginally profitable outcome was hopeless.[56] At that stage and having dissipated much of the huge wartime surpluses in attempts to improve service, the railroads threw in the sponge and simply let service and equipment deteriorate. This phase provides most of the anecdotal evidence of deliberately poor service, rudeness of personnel, indifference and so on.[57] Hilton is probably correct when he notes that "by 1958 railroad passenger service had demonstrated itself to be the most uneconomic activity ever carried on by private firms for [such] a prolonged period."[58]

## ICC POLICY

From 1940 when the Commission was given substantial authority over all modes of transportation except aviation, and presumably had developed some concept along the lines of the "grand design" noted in Section III, nothing positive was done until after the war. During the war, President Roosevelt by-passed the ICC and created a separate Office of Defense Transportation (ODT), much as President Wilson had ignored the Commission in the earlier war, though not resorting to federal control. Apparently the Commission was not held in high enough regard to coordinate the transportation industry during either war even though it had jurisdiction over by far the largest proportion of transportation assets, and in the *Transportation Act of 1940* was charged with coordinating the transportation system. To be sure, Joseph B. Eastman was chosen to head the ODT but not because he was an ICC commissioner but because he was a man of exceptional talent and leadership abilities. His death in 1944 was a serious loss to the Commission since no commissioner "of comparable talents rose to take his place."[59]

It was not therefore until the post-war period that the Commission had the opportunity to see what it could do about improving the performance of the transportation industries through attempts to implement its grand design. The results speak for themselves. By the mid 1950s the railroads faced financial disaster again. Part of this was due to ICC policies that have regularly been viewed as inconsistent, vacillating, uneconomic and otherwise misplaced or foolish. I submit however that the Commission was attempting to implement a larger vision of the mandate of the *Transportation Act of 1940* than perhaps Congress had in mind.

Certainly the Act was interpreted by the Commission as involving a multiple set of objectives that made enforcement difficult. For example, the Commission asserted that in any important case it must consider the "economic effects on all shippers, on towns, cities, ports and regions, on the carriers themselves, and, of course, on the consumer"[60] in addition to the "needs of the commerce of the United States, of the Postal Service, and, of the national defense" as the *Transportation Act of 1940* put it in its policy statement. Without having some notion of the Commission's relative weighing of these several objectives, it is not possible to judge its decision in any case. Worse still, since the Commissioners themselves have never provided any information on the importance they attach to any specific objective, it is clear that every decision is "justified" or justifiable under some set of weights that seemed to shift from case to case. Furthermore, there is no presumption that the objectives are economic in nature despite the adjective "economic" in the foregoing. Thus Commissioner Webb, in referring to the frequent use by the Commission of average costs containing many items that are arbitrarily averaged into any given figure and hence having no relevance whatsoever to what economists mean by "marginal" cost, explained that:

> the allocation of constant costs to specific traffic . . . is essentially arbitrary . . . There is no doubt in my mind that such fully distributed cost constructions are bottomed on economic fallacy. . . [But] this form of economic nonsense . . . may be entirely sound from a regulatory point of view . . . [because] regulation is designed to achieve a number of important objectives, the value of which cannot be determined on purely economic grounds.[61]

This non-economic aspect goes back to the beginning of the Commission. In its first annual report, the ICC stated that "[i]t was . . . seen not to be *unjust* to apportion the whole cost of service among all the articles transported, upon a basis that should consider the relative value of the service more than the relative cost [emphasis added]."[62]

There are complaints that the ICC "has been on all sides of the ratecutting question" because in one case it required rail rates to be raised "to match those of their river-truck competitors" while in another it asserted that "no carrier should be required to maintain rates which would be unreasonable, judged by other standards, for the purpose of protecting the traffic of a competitor," and in another case that "a rate should 'not be lower than necessary' to secure a fair share to traffic." These decisions do not mean inconsistency,[63] rather they reflect ICC's multiple objectives. Higher rates above rail costs may be justified on the grounds of protecting the traffic of other common carriers to keep them in business in the event of defence needs and to preserve their "inherent advantages." Rates closer to costs but still compensatory may be justified in competitive situations if they retain or attract traffic from less regulated or exempt carriers.

Any rate change is bound to have differential effects on ports, other carriers, consumers, national defence and so on depending upon the situation of the specific case. Thus it is unfair to castigate the Commission for its case-by-case approach and failure of enunciate a uniform policy applicable to all cases. To be sure, the Commission's approach creates a lot of confusion and uncertainty as to the outcomes of any case. This also causes much delay, as well as income for lawyers and consultants of various kinds as each case is explored in all of its dimensions by all interested parties. Most of the delay is a product of the legalistic approach required by the *Administrative Procedure Act* (1946) but it is also implicit in the ICC's view that each case is virtually *sui generis*.

The Commission supported legalization of railroad rate bureaus which finally became law over President Truman's veto in 1948. In many ways the ICC sought to have the common carriers, regardless of mode, behave like a multi-enterprise cartel dedicated to the public interest though still under private ownership and management but influenced by regulation administered and interpreted by the ICC. In specific situations involving rail and truck competition, the Commission would apply a "share-the-traffic" criterion if the bulk of the rail and truck traffic involved common regulated carriers and would prevent rate competition that would jeopardize the net revenues of either mode. On the other hand, if there was actual or potential non-regulated (private, exempt or even contract) carriage, the Commission would permit the more regulated carriers to slash rates to levels barely above out-of-pocket costs if necessary, in an attempt to maintain at least some profitable *common* carriage in the particular business.

This was all part of a vain attempt to prevent the steady, increasingly evident erosion of regulated common carrier traffic to private, own-account, exempt or less regulated business. Other attempts involved increasingly rigid definitions over what constituted permissible non-common carrier status, such as reducing the number of contracts allowed to a contract carrier before its status became de facto "common" and hence subject to the full panoply of ICC rules and regulations; narrow definition of exempt commodities under the agricultural or bulk commodity exemptions in the laws applicable to truck and water transportation; and the extreme "poisoned vehicle doctrine" that held that any specific *vehicle* that had ever carried an exempt commodity was forbidden from ever again carrying non-exempt freight!

The totality of Commission activities between 1940 and the mid 1950s suggests that interpreting the vision as a "Grand Benthamite Design"[64] or simply "grand design" as mentioned earlier sheds some light on what the Commission did or was trying to do. The argument goes as follows:

> Rate regulation as practiced by the ICC, if completely effective, would maintain higher rates on specific traffic than would otherwise occur, would involve greater rigidity, tend to preserve a demand-oriented rate structure, reinforce misapplication of value of service pricing but emphasize commodity discrimination as the most effective way of covering the nonassignable costs, frequently allow more than one mode to participate in a given piece of business regardless of relative costs, consider a wide variety of noneconomic objectives and externalities, treat each case as *sui generis*, more effectively prevent rates from falling below marginal cost, and would force a kind of public accountability and greater cost consciousness upon the common carriers. Insofar as one can impute rationality to contemporary regulation, the overall impression is that the Commission seeks a rate structure such that all nontraceable costs including those additional costs arising from pursuit of noneconomic objectives and the added duties of common carriage are recouped from shippers on the basis of willingness and ability to pay; that is to say, the markup over computed out-of-pocket costs would be determined by the relative level and elasticity of the demand for transport of particular commodities. Individual rates would be adjusted from the maximum profit level by consideration of external economies and diseconomies as far as regulated carriers are concerned and overall profit limitation is implied. Rate regulation, if completely effective, thus attempts, albeit in a crude and implicit way, to assess the benefits to the regulated carriers as a group and weigh these against whatever externalities appear to emerge in particular instances. It is true, of course, that, unlike Bentham, the ICC does not explicitly add up the net benefits to each shipper, carrier, and community involved or affected and then strike the balance, approving those rate changes for which the sum of the net benefits exceeds zero and disapproving all others. But the frequent

> references to injury or noninjury to some shippers, regions, defense interests, or other carriers due to proposed rate changes, suggests that an interpretation of rate policy in terms of Bentham's felicific calculus may not be so farfetched as it seems on the surface.[65]

Granting for the moment that this was the (mostly implicit) vision that derives from ICC actions, it still does not exempt the Commission from charges of failure to promote coordination among the modes. Nor is it exempt from charges that its activities, however well-intentioned, did little to preserve common carriage. In fact, it helped reduce common carriage which in many respects had become somewhat obsolete anyway. It is also true that the railway situation would probably not have been significantly different regardless of the Commission's actions. The forces of technological change that so improved the operations of the railroads' principal rivals and the massive support given by the federal government for right-of-way and technical development of the vehicles, especially aircraft and its close association with the military, would have led to the relative demise of rail freight traffic anyway and the absolute demise of passenger traffic too, in fact much sooner, had efficiency criteria prevailed or been influential earlier. Nor can one avoid the conclusion that the "grand design" was enormously wasteful in economic terms, of which more later.

## THE WEEKS REPORT

In any event by the mid-1950s another rail crisis loomed. Since part of the railroads' problem was associated with regulatory policies of the ICC about which something might be done, President Eisenhower appointed a Presidential Advisory Committee on Transport Policy and Organization with Sinclair Weeks, the Secretary of Commerce, as chairman. It was popularly referred to as the Weeks Report.[66]

The Report, released on April 18, 1955 was primarily about railroads and freight. However three of its main items have relevance to passenger travel by rail and other means and indeed were influential in the *Transportation Act of 1958*.

Two views prevailed at the time concerning what to do about transportation policy in general:

(1) extend the authority of the ICC because much of the malaise was the result of incomplete jurisdiction. In passenger travel, the Commission had no authority over aviation, private transportation by auto and intrastate bus travel. In freight, regulation was complete over rail but barely one third of truck ton-miles and between 10 and 15 percent of inland water transport were subject to ICC regulation. For more complete coordination, it was argued, exemptions from regulation needed to be reduced. This applied mostly to private and exempt trucking where the Commission regularly tried to construe the extent of exemption narrowly. This approach was obviously mostly favoured by the Commission itself and those who believed that more regulation was essential to sustain common carriage, a transportation system constantly prepared for defence and a stable, dependable and ubiquitous system regardless of concerns for costs or profitability. In short, transport was viewed as a kind of public utility, available at most or all times between most or all places. It was a kind of entitlement and the "right to mobility" something akin to one of the basic freedoms.

(2) the other approach was to rely more on market forces and progressively strip the regulatory commissions of their authority. This was based upon two main premises: one, that the transport revolution over the past 50-plus years had rendered transport markets for both people and goods sufficiently competitive that public control, beyond the antitrust laws, was unnecessary and, two, that even if this were not totally the case, the existing system of regulation was so cumbersome, costly, unwieldy and unfair that it ought to be scrapped anyway.

The Weeks Report had elements of both of these views. Recognizing that the 1940 statement of national policy had been interpreted by the Commission as a directive to allocate traffic among carriers on its own discretion rather than via market forces, the Report stresses that a veritable transport revolution had taken place. "The net result is a competitive system . . . that has eliminated the monopoly element of . . . some thirty years ago." However, government has kept "and in fact, intensified its regulation." The Report therefore came down strongly in favour of "increased reliance on competitive forces . . . in rate-making," one of the first of such utterances to emanate from a prestigious government source.

However, the Report could not break away from the past completely and recommended that rate competition take place only within a range determined by the ICC. This kind of ambivalence persisted throughout; namely recommendations that would permit a more market-oriented approach on the one hand while, on the other hand, strengthening or broadening the scope of regulatory authority. For example, to help maintain, however artificially, a common carrier industry, recommendations were made to narrow the extent of exempt and private carriage in trucking. Defence issues also loomed large with great stress placed upon maintenance of excess capacity which involves an inconsistency since reliance upon competition would preclude persistent excess capacity. It is impossible to maintain a strong competitive common carrier industry and excess supply in the event of hostilities unless the excess is kept out of commercial competition which is not the tenor of the Report.[67]

The main aspects of the Report and the resultant *Transportation Act of 1958* of relevance to passenger transport include those items placing more reliance on market forces and those moving further toward regulatory control. The latter would tend to preserve rail intercity passenger service and the former reduce it. The Report stressed that "losses incurred from passenger service . . . must be borne from earnings realized from freight service. . . . Thus railroad shippers . . . are being required to subsidize . . . those who benefit from the utilization of passenger train services." This was a strong plea to place rail passenger abandonment in the hands of the ICC and away from the states and make the Commission decide when such deficits impose an "undue burden upon interstate commerce." This was a tepid move toward market forces since it did not permit discontinuance upon the showing of unprofitability alone but dragged in concerns of "undue burden." Ironically, the original draft of the *Transportation Act* had provided that any demonstrably unprofitable passenger service might be discontinued. The removal of this provision for reasons relating to fear of elimination of suburban services in New York City, left the ICC without any specific criterion and, thus, free to decide such issues in conformity with its "grand design." On the other hand, recommendations for more rate freedom, even if only within a range specified by the Commission, would stimulate profits from freight shipments which would then permit continued subsidies to passenger service. Recommendations for federal loan guarantees for portions of rail plant and equipment purchases were also proposed and, other things being equal, this non-market effort would help support perpetuation of deficit passenger service.

Thus the Report was a mixed bag *en route* to liberalizing regulation. The resultant regulation in 1958 was equally mixed. Hilton, after an exhaustive study of it from the perspective of 10 years later concludes:

> two provisions . . . move in the direction of market allocation of resources. Section 15a(3) [prohibiting umbrella rate making] is a halting effort at decartelization, and to the extent that Section 13a accelerated withdrawal of passenger trains, it furthered the working of market forces. Unfortunately, such benefits as society achieved from these provisions were to some degree counteracted by the Act's two provisions which tended in the opposite direction: the guaranty of loans worked contrary to market forces for disinvestment in a declining industry; and the motor carrier provisions were . . . a straightforward extension of cartelization.[68]

## THE HOSMER REPORT

Howard Hosmer was an ICC examiner who was directed in 1956 to look at the rail passenger deficit and suggest ways to eliminate it or at least reduce it to tolerable levels, presumably in the hope that present arrangements might continue or that feasible alternatives to preservation might be found. Clearly the crisis stage had been reached. As the ICC Report one year after Hosmer's put it:

> The financial loss [from deficits] is real; it is large and appears to be growing; and it endangers the present and future welfare of the railroad industry. . . . [I]f this threat to realization of the objectives of the national transportation policy is to be substantially lessened, responsible efforts in this direction must reckon with facts as they are. If the statistical trends of 25-odd years prove any one thing, it is the folly of awaiting more fortuitous events. Though many people still prefer to travel by rail for one reason or another, they clearly constitute a minority — a minority that grows smaller with each passing year. Figures for 1958 show that for the first time in the 70 years of recorded history of the American railroads, their passengers numbered less than 400 million. This decline has occurred against a background of an expanding population with more time, means and the desire for travel. In terms of intercity passenger-miles, the 'travel market'

> increased almost 60 percent from 1940 through 1957. Though the total 'for-hire' share rose by slightly less than 9 percent, railroad passenger-miles declined 27 percent.[69]

There was certainly little time to lose. Though the ICC Report was in large part based upon Hosmer's, nevertheless it refused to accept his conclusions. Wishful thinking triumphed again when the Commission concluded that "We are of the view that the complete elimination of passenger-train service would not be a solution in the public interest. Economic railroad passenger service is . . . essential for the Nation's well-being and defense."[70] The Commission then enunciated 10 measures to somehow "save," and/or render economical, rail passenger service — only one of which was ever implemented: the 10 percent federal excise tax on passenger fares was repealed — not exactly a radical move. Nor did anyone suggest that even if all the measures had been implemented "economical" service was possible. Hosmer certainly thought not. We turn now to his analysis which is of relevance today.

After looking at the size of the deficit, he disposed of arguments that it was arbitrarily overstated by noting other studies arguing that the reverse was true. He deftly accepted the Commission's earlier finding that the figures, though based upon somewhat arbitrary but reasonable rules for separating expenses between freight and passenger operations "were adequate for the purpose for which they are intended," and turned to their causes.

On the demand side, he noted that the public at large had exhibited a distinct preference for air and automobile travel. Since the typical age of a rail passenger in 1958 was over 45, the bulk of the shift away from rail entailed more youthful riders whose future habits were unlikely to include rail after having become accustomed to the superior quality of the alternatives and who had by then gotten over any fear of flying associated with earlier air travel. Data at the time also suggested that the future of rail demand was severely limited because of several elasticity estimates which indicated that income elasticity for air and automobile travel was plus 2.5 and 1.2 respectively whereas that for rail was a *negative* 0.6. With rising incomes especially true in the United States of the 1950s and 1960s, the demand for rail intercity passenger service could expect to drop absolutely while increasing rapidly for its rivals. The rise in incomes also increased the value of time for travellers, especially business travellers, which generated even greater relative advantage to air travel and frequently to automobile and bus as well. As Hilton put it, "Only low-income people, persons with an irrational fear of flying, or aged persons whose alternative uses of time are negligible are likely to opt for rail."[71]

On the cost side, Hosmer argued that rail transport was more labour intensive than its competitors and less subject to productivity improvement. These facts, combined with the stringent operating rules applicable to rail labour, would make their cost disadvantage even greater, thereby further accelerating their overall demise. As if to bear out Hosmer's analysis, a study in 1966 indicated that rail costs per passenger for a 45 percent load factor between San Francisco and Los Angeles were between $18 and $25 whereas the air fare was less than $10 on one of the airlines and slightly over $9 by Greyhound Lines.[72] Since the rail fare had to lie somewhere between the other two because of perceived relative travel preferences, rail losses were inevitable, especially at the actual fare of $12.50.

Thus, given the apparently inexorable or, at least, most likely trends, the rail intercity passenger business was economically hopeless. Hosmer stated this without equivocation:

> For more than a century the railroad passenger coach has occupied an interesting and useful place in American life, but at the present time the inescapable fact — and certainly to many people an unpleasant one — seems to be that in a decade or so this time-honored vehicle may take its place in the transportation museum along with the stagecoach, the sidewheeler, and the steam locomotive. It is repetitious to add that this outcome will be due to the fact that the American public is doing about 90 percent of its traveling by private automobile and prefers to do so. . . . If the railroad passenger-miles (other than commutation) continue to decline at the average rate of reduction between 1947 and 1957, the parlor and sleeping car service will have disappeared by 1965 and the coach service by 1970. . . .[73]

The latter projections were almost precisely on track if one dates a new era for intercity rail passenger service in the U.S. from the formation of Amtrak in 1971 and the demise of most luxury services five years earlier. At least for the existing railroads, passenger service died as predicted.

Thus, on the eve of obtaining authority over passenger-train discontinuance, the Commission had at hand an analysis that would have provided an appropriate guideline for policy. This it chose to reject. While in the years following the *Transportation Act of 1958* many passenger trains were allowed to be dropped, the procedure was more prolonged, painful and costly than would have been the case had Hosmer's Report received the attention it deserved. The hopes of implementing the "grand design" more effectively despite such evidence presented by Hosmer of the power of market forces to effectuate change, made the Commission continue, like King Canute, to order the waves rolled back. Thus the railroads, despite growing rates of abandonment begrudgingly granted by the ICC, continued to suffer passenger losses ranging from a low of $375 million to a high of $524 million and averaging $426 million per year from 1959 through 1970.

## THE SITUATION IN AIR AND HIGHWAY TRANSPORT

While the railroads were having their problems and suffering from low earnings overall and continued miserable passenger performance, air and private travel reached new heights while bus service limped along. Economic regulation of air seemed at the very least to have accommodated such growth and perhaps helped it along marginally. Certainly public policy with respect to infrastructure mightily assisted all three. These issues will be briefly examined here in reference to the period before the heavy artillery was brought out to begin the attack upon the regulatory commissions in transportation following the timid beginning with the *Transportation Act of 1958* and the Weeks Report which were not even discernable salvos.

### Air Transport

The growth of the commercial side of air transport was phenomenal. Employment in the industry increased from a mere 13,000 in 1938, the year of regulation, and by 1958 exceeded 150,000. Revenue passenger-miles leaped from barely half a million to over 31 billion between these years and carrier revenues from $58 million to over $2.2 billion.[74] Rate of return on investment for the carriers averaged over 10 percent per year during the 1950s.

The airway development proceeded apace without charge to users and with direct subsidies linked to mail pay administered by the CAB from 1953 to deregulation in 1978 and directed mostly to carriers serving small communities. Airport development has accommodated and partly stimulated air traffic and carrier profits since state authorities and local governments generally build, maintain and operate the facilities at fees that normally do not cover operating costs and certainly not capital costs. In the new environment these implicit and explicit subsidies are being phased out.

Carriers acquired vast amounts of new and higher technology equipment. Ironically, in the year of the Hosmer Report and the *Transportation Act*, both of which involved the future of passenger travel by rail, jet aircraft were first introduced on domestic airlines thereby making Hosmer, at least, appear even more prescient. Newer, faster, more fuel-efficient and sometimes more comfortable aircraft have been introduced with singular rapidity ever since. The industry has been technologically extremely dynamic, perhaps too much so. In part the new technology improves quality of flight and this may have been excessively stimulated because the CAB early on adopted the policy of virtually eliminating rate competition among certificated carriers, forcing competition to focus upon the quality dimension. However, replacing an aircraft fleet with another more expensive before the first has been fully financed or paid for has often caused financial problems for the airlines along with fluctuating net earnings.

Suffice it to say that up until roughly 1960, U.S. airlines were dynamic, profitable and comfortable with both public *largesse* and direct economic regulation. In fact under the latter, no new trunk-line carrier had been allowed to enter the industry since the beginning of the CAB. Of the original 16 carriers in 1938, 10 continued to dominate the industry in the early 1970s, the other six having merged with the remainder. The CAB clearly "out-regulated" the ICC and in an industry where the workability of competition vastly exceeded that of railroads. Perhaps the earlier demise of the CAB in its entirety is just desert for cartelizing a workably competitive industry presumably in the public interest and after large amounts of subsidy seeking to promote it in the first place. The public paid at both ends.

### Highway Transport

Bus transportation had not shown much dynamism through the 1950s. In fact, total intercity bus traffic (class I, II and III carriers) decreased slightly during the decade in terms of passenger-miles and fell behind air for the first time in the mid 1950s and, of course, has remained behind since. It continued to dominate in number of passengers however, indicating the very short average length of trip, some 122 miles in 1983 and below 100 miles or less during the 1950s. The clientele come mainly from low income, non-professional groups, the relatively aged and very young, and whose travel purpose is primarily visitation of friends or relatives and sightseeing. These features seem to have characterized bus travel from the beginning and certainly since World War II, which probably accounts for part of the lack of dynamic growth of the number of passengers and passenger-miles over time.[75]

The chronic high level of monopoly power in the industry may also have contributed to its sluggish level of output and relative decline. Although the operating units are such that a competitive structure would be expected to emerge, both early state regulation and federal regulation as part of the *Motor Carrier Act of 1935* succeeded in creating a high degree of concentration especially in a single company, Greyhound, which dominated the industry for over 60 years. Along with Trailways, the two companies accounted for over half of all intercity carrier bus-miles and over 60 percent of total industry revenue in 1976 and similar proportions in the earlier periods. It is an understatement to assert that "concentration is overwhelming in the bus industry."[76]

Obviously for some submarkets or city pairs there may be effective rivalry from other modes, but in general it appears that regulation has helped to fashion another cartel out of a potentially workably competitive industry although there is no evidence that, following deregulation, the competitive nature of the industry has changed. The industry has simply not exhibited any signs of innovative development or dynamic growth even though its clientele has grown and presumably the number of tourist trips as well. There has been limited technical change in the basic vehicle and a pretty steady relative shrinkage in share of total intercity passenger-miles to insignificance. Regulation has also led to some cross subsidy with local service deficits being made up from small surpluses in intercity service including express and other incidentals.[77]

Unlike rail passenger traffic, the bus industry does not appear to be destined for extinction. Although rates of return have decreased in recent years, they were not completely negative during the 1950s. Nor has the trend been downward for other indicators except in a relative sense. For thousands of small communities, buses provide the only commercial access and egress and are of the sort that may well be suited to the non-business, non-professional patrons' needs, especially the elderly.

In the meantime private highway automobile travel continued to burgeon after the war. Fuel rationing ended, tires became available once more, Detroit geared up its formidable production apparatus and highway expansion and improvement went ahead with a vengeance culminating in the beginning of the Interstate System under President Eisenhower. Intercity auto travel rose from 383 billion passenger-miles in 1949 to 706 billion in 1960, and from 85 percent of the total to more than 90 percent. Automobiles improved markedly in styling, comfort, convenience and, to some degree, in safety and fuel economy during the 1950s although there was much more emphasis upon these later.

But the big events were the highways themselves. The National System of Interstate and Defense Highways, the "Interstate System," was created by the 1944 *Federal Highway Act* but funding for it was not approved until 1956. Two more highway Acts in 1956 set the system at 41,000 miles, later extended to 42,500 miles, and authorized new methods of financing both the Interstate and other federally aided systems. The Interstate is one of the largest public works endeavours in history. Ninety percent of the system is funded by the federal government and while its length only constitutes about one percent of total U.S. highway mileage, it accommodates over 20 percent of all highway traffic and connects virtually all cities (with populations of 50,000 or more in 1956) with limited access, multi-lane roads. The federal role also covers the ABC Program which includes primary and secondary highways and extensions into urban areas. The federal share of construction costs for this more extensive coverage began at 50 percent in 1956 but was raised to 75 percent in 1974, still somewhat below the 90 percent for the Interstate System. Overall federal expenditures for highway construction cover about 20 percent of the nation's total street, road and highway mileage.

A most significant aspect of the *Highway Revenue Act of 1956* was its creation of a Highway Trust Fund into which federal taxes associated with highway use are placed and the total each year allocated for the construction of federal aid highways. Before the passage of this law, highway expenditures had been paid from general revenues which included receipts from a wide variety of taxes, levies, fines, fees and other sources of income to the federal government. The share that went to highways was then bargained for in a political process referred to as the annual budget. The trust arrangement, under which some or all of the proceeds of excise taxes on motor fuel, tires, tubes, as well as sales of cars, trucks, buses, trailers and heavy vehicles accrue to the fund, and total expenditures for construction are limited to such amounts per year. This is believed to have the advantage of assuring funds for future use since such tax receipts can be forecast with more accuracy than political bargaining over budget allocations on an annual basis. More important for efficiency purposes is that it provides a linkage between highway use and highway outlays. Since economic efficiency requires that prices charged for the use of publicly or privately provided rights of way should reflect their respective marginal social costs, this linkage is at least a step in the right direction.

For example, the favourable economic outcomes resulting from a largely procompetitive transport policy, require that suppliers of transportation services, as all other producers of goods and services, pay the full costs borne by society in producing such outputs. Even if the production of the output is for personal use, such as own-account automobile traffic, if the full costs of such production are not paid by the producer or immediate beneficiaries, economic waste will be the result. The producer, or in this case, the automobile user will have no incentive to "economize" on the number of trips made if each trip is not charged an amount reflecting the value of the resources used in making it. When using a commercially provided service, there will obviously be a cost involved to the user, namely the price or fare charged. But for an efficient outcome, this price must also reflect the value of all the resources used in providing the service that could be used to produce something else of value.

In the case of intercity traffic by highway, the issue of highway pricing or user-charges is of critical importance. If, for example, heavy trucks pay less than the costs they incur or impose, more freight traffic will move by highway than rail, other things being equal, which will create more highway congestion. This will raise costs for all highway users including cars, trucks and buses and will reduce quality (e.g. slower speed, more accidents, pollution, etc.). More accurate cost-based pricing for highway use might shift some traffic back to railroads and reduce highway congestion and pollution along corridors heavily used by trucks not paying their marginal social costs. Clearly, a viable intercity commercial passenger bus industry as well as private automobile users have a large stake in an efficient system of highway user-charges. The railway industry has historically complained about federal and state subsidies to trucks and buses by virtue of undercharging them for the costs of using the publicly provided rights-of-way and thus creating a competitive disadvantage. For the sake of efficiency within the entire transportation industry, both passenger and freight, a set of at least reasonably plausible, cost-occasioned user-charges is indispensable.

A properly designed fuel tax supported by licence and registration fees for vehicles, trailers and other highway user types, can come tolerably close to what is meant by marginal social cost. Indeed, this tax itself is a kind of synthesized price for highway services. It is not of course easy to determine the economically correct level of taxation nor the correct value of marginal cost for each segment of the overall highway system. There are many conceptual, empirical and analytical problems involved. But acceptance of the principle of linking specific taxes to variable highway costs will provide incentives to improve and sustain such a linkage especially in the context of a separate trust fund. It is in this sense that the creation of the Highway Trust Fund in 1956 has such an important set of implications for any policy that places greater reliance upon market forces. Highways themselves are productive assets and should be priced appropriately. The U.S. highway system represents a huge investment, and its use, expansion and improvement needs to be made on economic principles as long as we live in a world of relative scarcity because the resources used up on highways have alternative uses whose value exceeds zero.

## CONCLUSION

The post-war period through the 1950s saw significant further improvements in air and road infrastructure and a large expansion in use. The principles of more economical finance at least of highways were recognized and set into law. One could even see the glimmer of emergence of market orientation in economic regulation but not much. Yet in the background was a growing agitation among academics to change the system. Many others were becoming alarmed at the periodic crises that seemed to arise in all modes of transportation but mostly in rail. Debates were begun about what to do about it. Transportation, in short, began to rise in the national priority list of areas that needed attention.

# 5. EVOLUTION OF PRO-COMPETITIVE POLICIES: 1960–1982

The two decades beginning in 1960 saw the increasing strength of the regulatory reform movement and their ultimate achievements. These consisted of complete success in eliminating economic regulation in the airline industry along with the CAB itself, substantial deregulation of railroad, truck and waterway freight transport, elimination of most restrictions on bus passenger traffic and the removal of rail passenger service from the railroads themselves and integration of the service into a single, government-created organization called the National Railroad Passenger Corporation (Amtrak). Amtrak was given much discretion over fares and service but was also heavily subsidized and thus indirectly "controlled" by the government. The ICC remained in existence with sharply curtailed functions and authority although it managed to keep busy with aspects of the freight business that on the surface were surprising. Thus for example, the *Staggers Rail Act* that "deregulated" rail freight invited the carriers to discriminate in rates in a fashion that had led to the original Act in 1887 in the first place. Discrimination was supposed to be necessary to make the carriers "revenue adequate" and initially was constrained within a range of certain percentages above out-of-pocket cost (or marginal cost) for particular traffic. The Commission was to determine when carriers were "revenue adequate," what constituted marginal cost and make other findings such as "market dominance" as well. In short, the ICC was to preside over a government-mandated system of discrimination previously declared illegal. Clearly all was not as many economists had envisioned, and parts of the regulatory reform "victory" seemed hollow indeed. But the main point was that efficiency criteria were given primacy in most cases and that individual carrier discretion was vastly enlarged. Even discriminatory freight rates could be viewed as efficient when carriers were subject to an overall revenue constraint. A theorem, now called "Ramsey pricing," first developed by the eminent economist Frank Ramsey in 1928 and widely ignored by those economists unable to see anything beyond the marginal-cost-equals-price condition for efficiency, proved that for multi-product firms subject to a revenue constraint, prices which deviate systematically above marginal cost on the basis of the inverse of the elasticity of demand are optimal in the consumer surplus sense. Even the ICC pretended to espouse Ramsey pricing in a series of early cases after 1980 but, of course, could not do it correctly for reasons that need not be pursued here.

Regulatory reform of passenger business was virtually complete. The airlines, which carried almost 84 percent of commercial intercity passenger miles in 1980, were provided with most economic freedom which they had fought tooth and nail for over a decade. Passenger buses, accounting for about 11.5 percent of passenger-miles, were significantly deregulated while a single-firm monopoly, Amtrak, generated the remaining trivial amount. Thus well over 90 percent of intercity passenger transportation in the U.S. was, by the early 1980s, influenced almost totally by so-called "free market forces" in most of the relevant submarkets, namely, city-pairs. Certainly the goal of greater reliance upon market forces had its fullest expression in passenger transportation as compared with freight.

However it took over 20 years in the U.S. after the beginning of strong attacks upon the then existing commission-type regulation to bear fruit despite the ardent support of every president since Eisenhower. Even Eisenhower was sufficiently upset with the existing arrangements in transport to have called forth the Weeks Report which noted the end of the previous transport monopoly since 1920, talked about obsolete regulation and urged "Increased reliance on competitive forces of transportation in ratemaking."[78]

Economists, political scientists and other academics and the legal profession had likewise begun the attack in the 1950s and some much earlier. The procedures of regulatory commissions, in transportation and elsewhere, were severely criticized leading to passage of the *Administrative Procedure Act* (1946) which specified the requirements for fair hearings for all affected parties — a set of rules that was so abused by various regulatory commissions, including the CAB and to a lesser extent the ICC, that docketed cases took an average of almost three years to decide and many important cases took far longer. Regulatory delay became a basis for advocating reform long before 1960.

Before 1960 many observers had noted the decline in the apparent quality of regulatory Commissioners. No new Joseph B. Eastman arose in the ICC and the last CAB chairman before Alfred E. Kahn was described as the "worst ever." Not only were the Commissioners of poorer quality and often "political appointees" in the worst sense of that term, but their frequently cozy relationships with the presidents of the carriers regulated led to the widely held "capture" theory and questioning of just how "expert" and "independent" the Commissioners were.[79]

Thus the attacks upon regulatory commissions began much earlier than 1960. But the *nature* of the attacks shifted from procedures, internal operations and organization, venality and quality of the commission and its staff and the like, to the *effects* of whatever the regulatory agencies did upon the industries they were supposed to be regulating in the public interest. At this point, a bevy (perhaps "pretension"?) of economists turned their attentions to transportation once again as they had prior to 1930. As noted in Section I, the economic consequences, when properly advanced both in theoretical but especially in empirical terms, caught the attention of Congress and all the presidents since Kennedy. The present section outlines this story and seeks to explain both how anti-regulation forces finally succeeded as well as they did and why they took so long.

We begin with one of a series of reports and messages that tackled the problems of U.S. transportation and sought to provide solutions that would lead to sensible change. The change could take several forms: it could be new legislation mandating specific changes in the basic regulatory statutes and/or it could be changes by the commissions themselves in interpretation of existing law. For example, some years before legal changes were passed by Congress, both the ICC and CAB began to significantly alter past practices mostly in response to the ground swell of opposition to the *status quo* but also to avoid new Congressional mandates. It was said that deregulation of trucking occurred almost four years before the *Motor Carrier Act of 1980* because the ICC allowed almost every application for new entry into hitherto heavily protected markets starting in 1975-76. The CAB began urging new rate initiatives and permitted easier entry even before Chairman Kahn arrived on the scene which was several years before Congress passed the actual deregulation bill. Discussion of which approach is preferable will be deferred until the regulatory reform story has been examined.

## THE DOYLE REPORT[80]

This report, appearing in June 1961, shortly after the Landis Report had castigated regulatory agencies in general (see below), gave a further set of criticisms directed at the regulation of transportation, arguing that the "framework of present regulatory policy . . . has produced *a general program of preserving the status quo which is in direct opposition to the overall objective of a dynamic transportation system which can best serve the economy and defense of the country* [emphasis added]."[81] The Report then emphasized the essentiality of preserving common carrier service as the backbone of the system and stressed the need for regulation because "transportation partakes of the dedicated nature of public utilities. . . . [It is] in the public interest that a degree of stability and uniformity be introduced in the rate structures of the several modes . . . that at no time in the course of our review . . . have we found any serious recommendation that specialized regulation of transportation be discarded."[82] In particular the Report stressed that intermodal cooperation is desirable but that it cannot come about through voluntary means because there are "too many carriers . . . each promoting his own immediate self-interest . . . too much mutual distrust and antagonism."[83] Thus the desired amount of coordination "will have to come about through regulation or as a result of permitting ownership of one mode by another."[84] Even though the latter is to be encouraged and the Report so recommends, regulation is still needed.

On the general issue of deregulation and pro-competition, the Report takes a large step backwards. Thus, for example, it argues that "With the exception of farm to first market and certain possibly noncompetitive traffic . . . exemption from regulation of for-hire transportation is contrary to national long-range interest."[85] Indeed it seeks through appropriate regulation to achieve "the right amount of competition" and that this will "minimize the cost of transportation to our economy"[86] and lead to rates that reflect long-run marginal cost. Competition, on the other hand, will not "tend to produce rates closely related to long run marginal costs" and there are sound and "logical reasons for concluding that competition in transportation rate-making will not automatically tend to bring rates and costs into a close relationship."[87] Such relationships require a rate *policy*; that is, rate regulation. These kinds of statements buttressed by much argument in an otherwise rather thorough and well-conceived report, help explain why the movement toward policies stressing "greater reliance upon competitive forces" became so protracted in the U.S. Its study director was a rather well-known and prominent economist who should have known better.

The Report, while a little weak on the economics of inter and intra-modal rate competition, nevertheless is all-encompassing. After careful analysis of the specific issues, it made such recommendations as:

- more careful assessments of user charges for the already existing highways;

- the creation of an airway trust fund which is now in existence;
- creation of a Department of Transportation *mainly to coordinate public transportation investments* with apparent need to prevent excess capacity;
- development of a waterway trust fund and full user-charges for use of the publicly improved waterways despite contentions that they were to be "forever free," a contention which the Doyle Report labels erroneous and misleading;
- a careful assessment of urban transit problems;
- encouragement of transportation companies, as noted above;
- enlargement of motor carrier operating rights and so on.

Labour problems in transportation are discussed which usually are ignored. Many other detailed analyses of aspects of current policies that it sees as causing malaise for common carriers of freight are included.

However, in addition to urban transit problems, the Report also addresses intercity passenger transportation which is more directly germane to this essay. It notes that "Railroad intercity passenger service meets no important needs that cannot be provided for by other carriers, . . . possesses no uniquely necessary service advantages . . . [and] serves no locations which cannot be served by air or highway;"[88] it can only earn a place by "offering a combination of price and convenience which will attract business in open competition at full-cost fares."[89] The Report believes that so oriented and operated only in high-volume markets, some intercity passenger traffic could survive or at least "produce a far higher ratio of revenues to expenses."[90] The causes of the demise of this service include rail management apathy and unwillingness to pool equipment and services to reduce duplicate facilities. This in turn is related to the lack of "effective profit-responsible management of this service."[91]

To be sure, regulation and government creation of excess air and highway facilities have not helped. Yet the Report feels that all is not necessarily lost. "If this service goes to the museum with the stagecoach [as the Hosmer Report predicted], it will not be for the same reasons."[92] If existing management is incapable of overcoming "the problems of equipment interchange, trackage rights, financial realignments, managerial realignments and eliciting the reasonably unified cooperation of over 80 companies, *a national railroad passenger service corporation should be considered* [emphasis added]."[93] This more or less prescient proposal was however not to be implemented unless a recommended study indicated potential profitable operations based on conservative traffic and financial forecasts.[94]

This Report, coupled with the Landis Report to President-elect Kennedy, led to some administrative and procedural changes within the ICC and CAB which amounted to very little. Nor did the Report lead to new legislation possibly because its coverage of topics was so extensive, some of its recommendations exceptionally offensive to trucking and waterway interests, and parts of the analysis purporting to justify continued rate regulation were out of step with the times as well as analytically slipshod.

However, it represented something of an advance over the Weeks Report, continued the attack on the transportation regulatory agencies and reinforced the need for change. It was also a creature of the U.S. Senate and indicated a growing concern in that body for regulatory reform.

The Landis Report, noted above and in Section I, although not focussing upon the transportation agencies exclusively, kept the heat on all the agencies and indicated serious concern from the White House as well as Congress. Specifically, James Landis, who once developed the rationale for a compelling need for regulatory agencies, the "fourth branch of government," in the 1930s, now engaged in a merciless dissection of the agencies' failures, possibly out of a sense of betrayal of his regulatory ideal.[95] Emphasizing the appointment of weak, vacillating and non-expert commissioners during the Truman and Eisenhower years, the problems of capture and especially delay, the absence of any general policies for particular problems combined with the multiple impacts the agencies felt they had to consider,[96] the absence of concern for efficiency and so on were all highlighted.

Regulatory reform began to shape up as a leading issue in the first year of the Kennedy administration. While no new legislation was passed, the appointment of superior and highly motivated people to such agencies as the SEC, FCC and FPC led to intra-agency shakeups along similar lines that Alfred Kahn was to follow in deregulating the airlines. If Landis could complain in his report to Kennedy that "the fires that then [1930s] fed a passion for public service have burned low," Kennedy helped reignite them in the early 1960s. But alas, it was far more than inadequate personnel that ailed economic regulation of transport — it was the entire foundation and rationale for regulation and its increasingly costly consequences that needed change.

## PRESIDENT KENNEDY'S MESSAGE ON TRANSPORTATION[97]

The assault on transportation regulation continued when, by inadvertence, President Kennedy *ad libbed* during a speech that he was going to deliver a message to Congress on transportation in the near future. Nothing of the sort had been previously discussed.

Released on April 5, 1964, the message was "Hailed as the most comprehensive transportation proposal a president ever submitted to Congress."[98] Written by economists both within and outside the government, it bristled with concern for efficiency, low cost, economical service and so on. Noting that "pressing problems are burdening our national transportation system" and that existing regulations are a "chaotic patchwork," Kennedy argued that "less Federal regulation and subsidization is in the long run a prime prerequisite of a healthy intercity transportation network." The national policy required, among other things, that "the resources devoted to provision of transportation service should be used in the most effective and efficient manner possible; and this, in turn, means that users of transport facilities should be provided with incentives to use whatever form of transportation . . . provides them with the service they desire at the lowest total cost, both public and private."[99] This objective required unsubsidized, privately-owned facilities operating under the checks of competition to the maximum extent possible and reduced regulation. Users should also bear the full costs of both publicly and privately provided facilities. To move toward these goals, he recommended extension of certain commodities now exempt from all rate regulation for water carriers (bulk commodity exemption) and for motor carriers (agricultural and fishery products), to all carriers. Congress was invited to enact legislation to *limit the control of intercity passenger rates to the establishment of maximum rates only.*[100] And so it went on to recommend "consistent policies of taxation and user charges" even for waterways; even-handed government promotion of intercity transportation mostly by phasing out subsidies; careful scrutiny of large mergers to maintain as many shipper and traveller options as was efficiently feasible; encouragement for establishing through routes and joint rates; and general stimulation of experimental rates, fares and services. Beyond intercity transportation, there is a long section on urban transit, one of the first of its kind and a major section on international transportation — neither of which are germane for present purposes but which do indicate the scope of the message.

It received wide press coverage and was greeted with much enthusiasm. However nothing came of it in terms of legislation. It lit a few more fires for dedicated public service and furthered the cause of transportation reform but it evoked substantial and powerful opposition. For example, a bill proposing exemption from minimum rate regulation for intercity passengers and transportation of bulk commodities and fishery products was opposed by the ICC, the American Trucking Associations, the International Brotherhood of Teamsters, the Association of Motor Bus Operators, the various waterway associations and many other groups. The grounds for opposition were mainly that equalization among modes should move in the direction of *greater* regulation of all of them, not less. The Association of American Railroads, the U.S. Chamber of Commerce and various agricultural, coal and shipper groups supported the proposals but only if they were amended to retain the exemption for the railroads in their minimum rate-making from the operations of the antitrust laws, an amendment rejected by all the other groups noted above who opposed the bill in the first place.

Legislation designed to implement other parts of the message evoked similar opposition. None ever got out of committee. The anti-deregulation forces were more powerful than recognized up to that time. There was widespread belief, especially within transportation circles, in the ICC's statement in opposition to the bill:

> If transportation teaches any one thing, it is that while competitive forces generally are effective in reducing prices and improving standards of service, these very same competitive forces in the transportation field, unless subject to reasonable restraints, will result in eliminating competition and in disrupting reasonable and fair rate relations as between competing shippers, geographical areas and territories.[101]

This reflects and reinforces the view that in some sense transportation is unique, that it is vitally important, has enormous positive and negative externalities, and so on that require regulation of some kind beyond the discipline of competitive markets. Even the Doyle Report had some of this attitude. Yet the sense in which it is unique is seldom spelled out. Certainly the cost functions of the various modes do not differ from those of most other industries. The fact that transport provides a perishable service is scarcely grounds for alarm in an economy where two thirds of GNP is generated by services rather than goods production. Nor are any of the modes "natural monopolies" in the sense of being subject to scale economies. Obviously air, motor, bus and waterway transport of people or goods are far from being naturally monopolistic. There is less assurance about railways, but for many decades the view that unit costs decline with volume of production of either passenger- or ton-miles was regarded as demonstrating economies of scale when in fact it represents economies of density — quite a different thing. Railroads are probably *not* subject to economies of scale. Even if they are, there are upper limits to any rate or fare provided by other modes so long as all markets are reasonably contestable by any company that is "fit, willing and able."

Sometimes the "uniqueness" theorem is supported with the observation that transportation is essential for all societies for a whole lot of reasons that are too self-evident even to mention. However, essentiality is not unique. Food is essential for life and food production in most economies is usually left to market forces or, if not, should be. Indeed, agriculture is viewed as the quintessential industry where market forces work best if governments refrain from mucking them up through price supports, acreage limitations and other intrusions. The same is true of health care, housing and other so-called necessities of life. None of them have been subjected to the same degree of protective, promotive and detailed intrusion into every aspect of the businesses providing them as transportation, especially in a free enterprise economy.

The economic virtues of private ownership, operation and decision making in response to profit opportunities, suitably constrained by competition and circumscribed by general rules of the game set down in law and subject to change via democratic processes, has been apparently vindicated by worldwide events of the last two years. Most assuredly this does not mean *laissez-faire* in the extreme sense. Even Adam Smith recognized legitimate and necessary roles and activities for governments. Some of these issues involving transportation will be discussed in Section 6. But some obvious ones may be mentioned here. They include antitrust laws to preserve competitive options; efforts to eliminate negative externalities consistent with market processes such as making private and social costs coincide as closely as possible; and efforts to maintain full employment, steady growth and a tolerable income distribution. Changed conditions in transportation had created, long before the end of World War II, a set of circumstances which rendered the pre-existing regulations of the industry at best inappropriate and at worst far more costly than any discernible net benefits to society and the economy as a whole. This was the message that was left to the economists to present as forcefully as possible. Part of this required debunking the uniqueness theorem and with it the Grand Transportation Mystique.

The strength of the opposition to regulatory reform seemed rather surprising at the time (early 1960s) as did the failure of the Kennedy message, given his initial enormous popularity. What was not recognized was the extent of the vested interests that had grown up around the existing regulations. In addition to heavy Congressional lobbying by railroads over many years, joined by the increasingly powerful American Trucking Associations, the Teamsters Union and others noted above, there were considerable financial contributions to the campaigns for electoral office at all levels of government by the various modal and other interests concerned with keeping things as they were. This is, of course, standard operating procedure in the U.S. even though there have been constant attempts to control its abuses over the years. Nonetheless, it remains a powerful force for maintenance of the *status quo*. But in addition, the laws affecting transportation economic regulation were so complicated and subject to so many conflicting interpretations that an entire cadre of transportation lawyers for decades has made a very good living from representing transport firms before the ICC, CAB and the courts at all levels. With them, accountants, statisticians and economists were increasingly involved. Hundreds of private consulting firms have found their bread and butter in transport cases, litigation and simple hearings before administrative law judges.

Even when Congress thought it had changed the law, as in the *Transportation Act of 1958*, the ICC interpreted it in such a way as to imply that little had really changed. This was also true of parts of the so-called 3R and 4R Acts passed in the 1970s. The Commission's scope for interpretation was extremely broad and it used this to maintain the *status quo*. However, this had one possible advantage, namely that if new, reform-type Commissioners could be appointed, sensible changes might be feasible without new legislation which took so long, required so much compromise, and even then was uncertain. Indeed, I once argued, prior to the legislation of 1980, that "there is nothing in the *Act to Regulate Commerce* as it now exists to prevent the ICC from doing any or all of the things that the proponents of regulatory reform recommend. The reason we have been forced to legislation is that the commission will not do them . . ."[102] If only it had been this simple! As many have pointed out, for any long-range guarantee that the reforms will stick, legislation is needed for the very reason it is harder to obtain in the first place. One can replace Commissioners with different viewpoints even if it takes a while (that is, at most one term if resignation cannot be induced or ill health speed things up) so that new administrations can easily re-regulate. Indeed, there is now a growing pressure for re-regulation in the transport industries in the U.S.

## AFTER PRESIDENT KENNEDY

After President Kennedy's death in 1963, President Johnson accepted deregulation and the emphasis upon efficiency in transportation. While declaring the high importance of transportation reform he soon became obsessed with the civil rights movement and increasingly with the Indochina War. Unable to devote much time to transport, he nevertheless succeeded in creating the Department of Transportation (DOT), a long-time objective of many reformists and advocates of more coordination, which is to say, almost everybody. Thus, although sending a transportation message to Congress that emphasized the need to create a National Transportation Safety Board, to do more research on the SST and high-speed ground transport, and promoted transport coordination through a new federal department, only widespread, general support was forthcoming for the DOT, which began operations on April 1, 1967. Although not in direct opposition to the ICC, the DOT has supported regulatory reform and has made legislative proposals usually supported by the White House almost every year. Most got short shrift until the late 1970s.

Johnson's Council of Economic Advisers began a series of what were to become increasingly strident criticisms of transport regulation in each of its Economic Reports. Beginning in 1966, a section entitled "Efficiency in Transportation" was included. It advocated the DOT, of course, and discussed the role of competition in forcing rates toward marginal costs. But it was still partly in the regulatory mold. "While controls over entry and abandonment are surely *desirable* [emphasis added]," it opined, "considerably more flexibility would seem to be appropriate."[103] This is pretty timid stuff but the beginning of another aspect of the attack on the transport *status quo* that continued fairly regularly and broadened in scope through the 1990 *Economic Report of the President*. What clout it had is difficult to say. In the 1960s, the Council of Economic Advisers had considerable stature, status and support of the President but its repute had dissipated by the 1980s. It was, however, only one facet of the economists' continuing attack on transport regulation. The attack was rendered far more powerful as economists were hired in ever larger numbers and quality in various branches of government.

## THE ECONOMISTS' ROLE IN TRANSPORTATION REFORM

The 1960s ended without much in the way of regulatory reform. However, the economic case for it had been well prepared and increasingly documented since the late 1950s and throughout the 1960s. In very general and overly brief terms, the case involves two interrelated parts. The first is that since the 1920s at least, the technical changes in transport — namely the automobile, truck, bus and airplane, and the associated highway and airway investments and progressive improvements in all phases of these technologies — had created an enormous and growing supply of transport capacity alongside the earlier dominant railroads already suffering from overcapacity. Thus the potential competitiveness of transportation between most city-pairs was vastly increased. Virtually all such markets had a sufficient number of traveller and shipper options supplied by independent carriers to make competition at least workably competitive. At the same time, it made economic regulation incredibly complex if not virtually impossible. In short, regulation became impossible to perform with any degree of rationality, reasonableness or efficiency; at about the same time, give or take a decade or two, it became unnecessary.

The problems of regulating the "new" industries of highway transport (truck and bus) and airlines which used publicly provided, improved and maintained rights of way, with little evidence that particular users paid appropriate amounts for either the costs they occasioned by such use or benefits received, created sharp differences among the modes including the railways. Any attempt to regulate for competitive equity or even to discover, let alone preserve "inherent advantages," as the ICC was enjoined to do, was virtually impossible. The large number of firms brought under regulatory purview, especially that of the ICC, with the necessity of making "grandfather" exemptions, exemptions for private carriers in motor transport and lesser regulation of contract carriage by truck or bus, vastly complicated the regulatory process. Meaningful distinctions among common, contract, exempt and private carriage are impossible to make and enforce. When certain commodities were declared exempt by statute, the situation became even more absurd. Court cases and much Commission time was expended on such trivia as whether frozen chicken is a manufactured or an agricultural, and hence exempt, commodity.

All the regulatory agencies became weighted down with trivia. Cases took years to conclude in part because of the new complexities but also because of the over-zealous use of "due process." The vastly different cost and demand functions relating to these disparate industries defied anything like a unified, basically anti-competitive approach that attempted to preserve something referred to as "common carriage," itself becoming increasingly obsolete and irrelevant with the new powers of own-account transport of people and goods. The ICC even used different profit concepts for rail and truck or bus, namely rate of return for the former and operating ratio for the latter. Even with enormous wisdom and administrative talent, the Commissioners could not cope with such a morass especially when the legislation they were operating under was vague, subject to a wide range of interpretation and in many respects inconsistent. But during the 1940s and 1950s and even later, Commissioners were appointed more frequently on political grounds and were distinctly inferior in their concern for and knowledge of the industries under their charge.

Given these considerations, the ability to carry out any grand Benthamite design was rendered worse than impossible. There was no way the Commission could possibly weigh the advantages and disadvantages to shippers, travellers, regions, ports, national defence, the needs of commerce and the Post Office in any given decision. Not only could the benefits and costs not be measured with any degree of accuracy but there was no weighting system that made any sense nor did the Commission ever reveal any systematic set of preferences except for common carriers. In fact, the weights seemed to vary from case to case. Thus the system collapsed for the same reasons that Bentham's felicific calculus collapsed — an inability to measure or weight the impacts using any standard metric that was additive. The Commission's decisions then became whimsical, without a rationale that could even be used as a precedent in other cases because the relative importance of the several impacts upon the multiple considerations alleged to be considered varied from case to case. This was *sui generis* with a vengeance.

Although the CAB never adopted an apparent grand design of such scope, it ran into similar problems because it sought to create and administer a cartel, oriented to sustaining the profitability of the *scheduled* carriers over time. If the economy was buoyant and travel demand brisk, the Board could be more lenient in granting new services or increased competition on certain routes and even encouraged discount fares. On the other hand, when times were difficult and carrier profits threatened, the Board allowed few new entrants and discouraged price reductions contrary to what a market-oriented policy would require. Thus the policy seemed to fluctuate between pro- and anti-competitiveness depending upon the general economic situation. As has been noted, "The CAB usally was vigorously anticompetitive when the airlines were suffering financially, and it was relatively procompetitive when the airlines were prospering. Thus . . . CAB policies between 1938 and 1974 were a result of applying stable protectionist principles to changing economic conditions."[104]

Thus the Board could look as if it were not so flagrantly against competition from time to time even though it thoroughly applied controls over entry and competition for the benefit of a favoured few — the scheduled carriers. It was thus more able to carry out a more limited goal of seeking stable profits than the multiple goals of the ICC. Yet even with a single goal it was not very successful in creating stable earnings year after year and certainly not for each carrier. However, there were no bankruptcies among the majors. The airlines themselves favoured continued regulation, as did airline labour, among the highest paid in the country, and financiers of the industry. Despite the economic arguments about misallocation, excessive prices and costs, lack of price-quality options and other problems, there was little enthusiasm for deregulation of the airlines or for reducing significantly the regulatory powers of the CAB. Despite this, potential competition was constantly growing.

In general, regulation of transportation became increasingly complex, less effectively done or doable and less necessary as the competitive potential of transport markets grew. The "costs" of regulation began to exceed the "benefits" presumed to derive from it. Even the railroads came to support some deregulation by the late 1970s as their economic situation worsened.

Legislators heeded the deregulation cry when various economists began to calculate the costs of regulation. Such costs turned out to be enormous, between $8 and $16 billion in 1977.[105] Though based upon very flimsy assumptions which no one chose to question, they nevertheless caught the attention of legislators far more directly than generalized statements about the competitiveness of most transport markets and the supreme virtue and efficiency of market solutions over regulatory ones.

The task now became how to get these virtually unanimous conclusions about the need for transport regulation reform, something very rare among economists, out of academia and the professional journals and into the mainstream of policy discussion and decision making in Washington. This process was aided by several Washington "think tanks" including the Brookings Institution, probably the best of them all, and one or two others which sponsored programs of studies on economic regulation of business and produced numerous volumes, articles, pamphlets and conferences on the findings. Most of these were written or conducted by scholars in economics, political science and other policy-based, social science research. This helped capture attention in the right places for policy reform in transportation and gave experience to academics who would be appointed to government agencies also concerned with the issues.

Such agencies as the Council of Economic Advisers, the Antitrust Division of the Department of Justice, the Department of Transportation (after 1967), the Office of Management and Budget as well as presidential task forces and Congressional studies (such as the Doyle Report and the National Transportation Policy Study Commission of 1979) virtually gobbled up economists who evinced any talent and/or interest in the economics of reform especially if it were pro-competitive. Since the profession as a whole was pretty unanimous on this point, there were many economists available. As has been said, by "1970-71, there were enough active advocates of regulatory reform inside the government to constitute a small, informal community, loosely bound by personal acquaintance and commitment to a shared policy goal. What had begun as a random critique of government policies . . . in a decade had evolved into a moderately concerted effort with a substantial official and quasi-official base."[106]

Economists were now in a position to do something more than simply argue the case. At the centre of much of this activity was transportation since it was not only a large and important segment of the economy but the first to have been subject to the kind of economic regulation now under attack and in which regulation had been hastily expanded to include railroads' competition thereby providing further ammunition for reform.

Almost from the beginning, the reform movement in transportation had support from the executive branch. Presidents Kennedy, Ford, Carter and Reagan gave high priority to it as did Johnson and Nixon, although the latter were unable to spend much time or effort in the cause.

However, to obtain the desired legislative change required sympathetic understanding from Congress. For a variety of reasons, the issue of transport reform, especially of air and truck transportation, was taken up in the early 1970s by the most publicized Democrat and one of the most powerful Senators in the legislative branch, Edward M. Kennedy. His advocacy virtually ensured passage of the bills deregulating both airlines and motor carriers. The story of airline deregulation and Kennedy's role in it will be told later in this section.

One more ingredient was needed to get legislation passed. It had to be shown that without it there would be dire consequences for the nation. Transportation had to become a high-priority item on the national policy agenda. However, the 1960s did not indicate much of a crisis. Rail passenger deficits remained high but stayed below their peak levels (which averaged $680 million in the seven years before the *Transportation Act of 1958*) averaging about $420 million per year from 1960 to 1970 as the ICC accelerated abandonment. (See Table 2.) There seemed to be no railroad "crisis." Airlines were doing quite well, buses continued their unspectacular but not dismal performance and the economy was progressing nicely with low unemployment rates, and better than average economic growth. Although fears of inflation led to a tax surcharge in 1968 and the Vietnam War had occasioned urban riots, campus uprisings and a souring, contentious mood throughout the country, transport problems, when thought about at all, were far from uppermost in public perception. Invoking the admonition "If it ain't broke, don't fix it," there seemed little point in using up political or other capital to tackle the problems the academics saw in transport. "Thus procompetitive regulatory reform was well and widely articulated as a policy prescription; but it remained a solution in search of a widely perceived problem . . ."[107]

*Table 2*

## Output and Financial Performance of American Railroad Passenger Service, 1920–1970

| Year | Passengers (thousands) | Passenger-miles (thousands) | Net revenue[a] (thousands of dollars) | Passenger deficit as percentage of freight net revenue |
|---|---|---|---|---|
| 1920 | 1,269,913 | 47,369,906 | | |
| 1921 | 1,061,131 | 37,705,737 | | |
| 1922 | 989,509 | 35,811,046 | | |
| 1923 | 1,008,538 | 38,294,178 | | |
| 1924 | 950,459 | 36,368,290 | | |
| 1925 | 901,963 | 36,166,973 | | |
| 1926 | 874,589 | 35,672,729 | | |
| 1927 | 840,030 | 33,797,754 | | |
| 1928 | 798,476 | 31,717,566 | | |
| 1929 | 786,432 | 31,164,739 | | |
| 1930 | 707,987 | 26,875,642 | | |
| 1931 | 599,227 | 21,933,345 | | |
| 1932 | 480,718 | 16,997,426 | | |
| 1933 | 434,848 | 16,368,635 | | |
| 1934 | 452,176 | 18,068,635 | | |
| 1935 | 488,059 | 18,509,497 | | |
| 1936 | 492,493 | 22,459,781 | –233,327 | 26.2 |
| 1937 | 499,688 | 24,695,214 | –241,591 | 29.2 |
| 1938 | 454,508 | 21,656,918 | –255,263 | 40.8 |
| 1939 | 454,032 | 22,712,941 | –250,934 | 29.9 |
| 1940 | 456,088 | 23,815,598 | –262,058 | 27.8 |
| 1941 | 488,668 | 29,406,250 | –226,029 | 18.5 |
| 1942 | 672,420 | 53,747,029 | 89,329 | — |
| 1943 | 887,694 | 87,924,994 | 279,790 | — |
| 1944 | 915,817 | 95,662,501 | 234,103 | — |
| 1945 | 897,384 | 91,826,353 | 230,060 | — |
| 1946 | 794,824 | 64,753,699 | –139,736 | 18.4 |
| 1947 | 706,551 | 45,972,245 | –426,526 | 35.4 |
| 1948 | 645,535 | 41,224,319 | –559,782 | 35.9 |
| 1949 | 556,741 | 35,133,300 | –649,627 | 48.6 |
| 1950 | 488,019 | 31,790,470 | –508,508 | 32.9 |
| 1951 | 485,468 | 34,640,031 | –680,822 | 41.9 |
| 1952 | 470,979 | 34,033,245 | –642,390 | 37.3 |
| 1953 | 458,252 | 31,678,951 | –705,538 | 38.9 |
| 1954 | 440,770 | 29,309,861 | –669,533 | 43.4 |
| 1955 | 433,308 | 28,547,877 | –636,693 | 36.1 |
| 1956 | 429,994 | 28,215,728 | –696,938 | 39.5 |
| 1957 | 412,625 | 25,914,446 | –723,483 | 44.0 |
| 1958 | 381,623 | 23,295,262 | –591,543 | 35.7 |
| 1959 | 353,647 | 22,074,718 | –523,692 | 32.8 |
| 1960 | 327,172 | 21,284,084 | –466,289 | 32.9 |
| 1961 | 318,359 | 20,308,444 | –390,495 | 29.7 |
| 1962 | 313,084 | 19,926,466 | –374,993 | 25.2 |
| 1963 | 310,999 | 18,519,049 | –378,618 | 23.7 |

*Table 2 (cont'd)*

### OUTPUT AND FINANCIAL PERFORMANCE OF AMERICAN RAILROAD PASSENGER SERVICE, 1920–1970

| Year | Passengers (thousands) | Passenger-miles (thousands) | Net revenue[a] (thousands of dollars) | Passenger deficit as percentage of freight net revenue |
|---|---|---|---|---|
| 1964 | 314,386 | 18,271,322 | –389,008 | 23.7 |
| 1965 | 305,822 | 17,161,776 | –398,029 | 21.6 |
| 1966 | 307,530 | 17,162,776 | –379,744 | 19.5 |
| 1967 | 304,028 | 15,264,172 | –460,414 | 26.9 |
| 1968 | 301,372 | 13,163,541 | –462,129 | 25.8 |
| 1969 | 301,673 | 12,213,983 | –437,498 | 24.4 |
| 1970 | 289,469 | 10,785,746 | –449,579 | 26.2 |

**Sources: Interstate Commerce Commission, *Statistics of Railways in the United States; Transport Statistics in the United States*; James C. Nelson, *Railroad Transportation and Public Policy* (Washington, D.C.: The Brookings Institution, 1959).**

**[a] The ICC did not separate passenger and freight net earnings before 1936.**

The crisis to advance regulatory reform was not long in coming. Indeed in three successive crises or at least serious and widely perceived events, transportation in general and railroads in particular were catapulted into the limelight between 1970 and 1973 (a light they shared with Watergate and the 1972 elections). The first of these was the Penn Central financial collapse in 1970, four years after the ICC had approved the merger of the New York Central and the Pennsylvania railroads and two years after the Supreme Court had finally sanctioned it. The Commission's approval was an obvious mistake not only for commercial reasons, as the bankruptcy shortly thereafter confirmed, but for reasons of sensible public policy. For example, as I wrote to a colleague shortly after ICC approval in 1966 under the heading, "Reflections on the N.Y.C.–Pennsy Merger";

> The approval of this merger by the ICC clearly flies in the face of predominant thinking with respect to deregulation, rate freedom, and increasing reliance on competitive forces in transportation. The foreclosure of intra-railroad competition over the vast area encompassed by such a merger should give those advocating reduced regulation occasion for some second thoughts. Whatever one may think of the possibilities of intra-railroad competition and its potential effectiveness, it cannot be lightly discarded as a totally inconsequential force. The

> entire philosophy of increased reliance upon competitive forces presupposes the existence of competitors having roughly similar cost and service characteristics. Intermodal competition, to be sure, is vital and in general ubiquitous within regions but to increase competitive effectiveness, intramodal competition is also essential. Thus the issues of rate freedom, deregulation and mergers must be viewed as a whole. Cartelization of any large area of potential competition requires more effective regulation of rates, fares and service, not less. Thus, the failure of the Commission to consider the broader picture in this instance jeopardizes any future move in the direction of deregulation. A cynic may even be led to infer that the Commission fully recognized this and approved the merger so that the necessity for more regulation, and with it the future life of the Commission itself, would be assured.
>
> To be sure, perhaps the estimated $80 million in savings will be achieved through elimination of duplicate facilities and all that. But against this must be set the dissavings that might be involved if the present regulatory system is thereby reinforced and rendered more impervious to change. I would guess that $80 million is peanuts compared to potential savings through substantial deregulation.[108]

Many people were incensed at the merger and frightened that the bankruptcy in 1970 would lead to liquidation. The combined roads constituted over 20 percent of total U.S. rail traffic and served a region of the country, the Northeast, that comprised 17 states and limited portions of other states, which accounted in 1970 for almost 60 percent of total industrial production and almost half the U.S. population. Any forced liquidation or even serious interruption of Penn Central service would have severe national impacts.

The second event, not unrelated to the Penn Central bankruptcy (possibly the most investigated and written about corporate failure in U.S. history) was the so-called Northeast Railroad Crisis. Referred to as "One of the most significant transportation occurrences of this century,"[109] it involved the bankruptcy of seven more railroads in the Northeast.

By this time the country, the Congress and the President were well aware of the railroad situation, its possible impact upon the nation as a whole and to a lesser extent how the causes were related to some more fundamental underlying malaise facing the entire transportation system. Out of these problems arose several legislative actions, in 1970 alone. The *Emergency Rail Services Act of 1970* was a financial bailout, in the form of loan guarantees by the government (that is, the Secretary of Transportation) to permit operations of Penn Central and other financially strapped railways to continue. More important for present purposes, the *Rail Passenger Service Act of 1970* created the National Railroad Passenger Corporation (Amtrak), to remove the burden of losses from cash-flow poor railroads already in bankruptcy. The Penn Central alone is reported to have absorbed nearly one third of the total national rail passenger service loss — something it could no longer continue to do and which helped bring about its financial collapse in the first place.

There was clearly considerable fear and panic in the initial legislative responses to the crisis in the Northeast, especially the Penn Central situation. In fact another "crisis" situation, a one-day strike against the Penn Central and its bankruptcy court threatening a liquidation unless public funds were forthcoming, initiated a sequence of events that led to the *Regional Rail Reorganization Act of 1973,* the so-called 3R Act. Thus began a planning process that had been suggested as far back as the *Transportation Act of 1920* although now on a more regional scale. The earlier suggestion regarding planning had been ignored by the ICC. The results after two years of planning amid enormous infighting and litigation among government agencies, as well as involvement of the railroads and many other affected interests, were the establishment of the Consolidated Rail Corporation, Conrail, and an unprecedented legal situation by which the federal government had planned and implemented a mandatory restructuring of privately owned railroads. Cries of "unconstitutional" were widely expressed but later resolved. In all this, the ICC and rail regulation were ignored except for creating the Rail Services Planning Office (RSPO) as part of the Commission to help in the restructuring process.

In short, there was much crisis-oriented activity in attempts to respond sensibly to the twin crises of the railroads in the Northeast. The creation of two new quasi-government corporations, Amtrak and Conrail, the billions of dollars of bailouts (or, euphemistically, loan guarantees) or outright subsidies, obviously captured the public attention and clarified that there was much unfinished business with the U.S. transportation system as a whole including issues of regulatory reform.

But even these attention-getting events and their train of frenzied activity were upstaged by another more ominous occurrence in 1973. The invasion of Israel by Egypt and Syria on October 6, 1973 set off the so-called "Yom Kippur War." The results of this further evidence of implacable Arab-Israeli eminity induced a hitherto harmless cartel, Organization of Petroleum Exporting Countries (OPEC), composed of leading oil exporting nations, to ignore the private international cartel, composed of large petroleum corporations, and arbitrarily raise oil prices and embargo shipments of oil to the United States and The Netherlands, both active Israeli supporters. By January 1974 the price of oil was raised from about $3 per barrel for Saudi Arabian light crude on October 17, 1973, to $11.65 per barrel. This precipitated the first of the major supply-side shocks the world was to endure and come to fear for the next almost 20 years. It precipitated world-wide recession and was a turning point in world economic history as growth rates of all the then leading industrial nations slowed sharply and have yet to regain their pre-1973 levels.

But for our purposes the oil crisis, as it was often called, even though the world has abundant supplies of oil and is in no danger of "running out," focussed attention on the transportation industries. It was quickly calculated that in the early 1970s transportation accounted for over half of total domestic use of refined petroleum products and about one quarter of total U.S. energy consumption. Of this, automobiles and trucks accounted for about three quarters of transportation's energy consumption. U.S. imports of petroleum and products were less than $4 billion in 1971 and earlier. By 1974 they totalled almost $27 billion and increased to a high of almost $80 billion in 1980. OPEC had seriously affected the world trading system and helped engender chronic balance of trade and current account deficits for the U.S.

This was serious business and called for an energy policy to stimulate greater efficiency in the use of oil and its products which in turn focussed attention upon transportation as a major user. To no one's surprise, it was calculated that railroads were the most efficient users of fuel for freight transport by a wide margin. BTUs consumed per revenue ton-mile of rail freight were far below those of truck or air. For passenger-miles the efficiency differences were less striking, but surprisingly Class I intercity bus travel was most efficient, followed by Amtrak, private automobiles and aviation the least efficient. See Table 3 for 1983 estimates.

*Table 3*
*RELATIVE FUEL EFFICIENCIES: BTUS PER PASSENGER-MILE*

| | |
|---|---|
| Class I Intercity Bus | 1,018 |
| Amtrak | 1,765 |
| Automobile | 3,498 |
| Certificated Air Carriers | 5,490 |
| General Aviation | 11,044 |

**Source: U.S. Department of Transportation, *National Transportation Statistics* (Washington, D.C.: Government Printing Office, 1983), pp. 121–27.**

These data, even if completely accurate, do not tell the whole story. They say nothing about the quality differences among the modes and are heavily influenced by the load factors on average for the several vehicle or plane types as well as variations among vehicles and aircraft themselves. Crude as they are however, they do suggest that the most fuel-effective way of moving people between cities is by rail and bus. Thus Amtrak and bus transportation should be encouraged relative to cars and planes especially general aviation! A new argument was added to go along with nostalgia and pollution to justify attempts to retain and stimulate rail and bus intercity passenger travel options and use, even if they needed to be subsidized. The excessive use of automobiles and air travel should correspondingly be discouraged. The value of time, comfort and convenience should be reduced and there should be efforts to improve the fuel efficiency of planes and cars. Attempts along all of these lines have of course been made and need not be detailed here. What is important for this discussion is how the above three events from 1970 to 1973 affected U.S. passenger policy during the 1970 to 1982 period when the last of the reform legislation was put in place with President Reagan signing the *Bus Regulatory Reform Act* in November 1982. The solution had finally found a widely perceived problem by the end of 1973. All the pieces were in place for regulatory reform.

The following discussion is confined to the three major changes pertaining to passenger transportation: (1) airline deregulation that went farther than any of the others; (2) the less discussed deregulation of the intercity bus industry; and (3) the deviation in the opposite direction in the creation of Amtrak.

From a position of almost zero interest in even modest pro-competitive reforms in 1969 to ardent advocacy in 1975 represents a sea-change for the CAB and the Congress.[110] Of the several reasons for this rapid change, the first is rather paradoxical, namely an even more anti-competitive shift than before on the part of the CAB beginning in 1969, with the economic recession which carried over through 1970. The recession led to a sharp reduction in traffic at about the same time new wide-body jets, ordered several years earlier in anticipation of continuing high-traffic growth and route expansion, were delivered. The ongoing wage-price spiral inflated operating costs; financial costs were rising as well. The reduced profits and profit prospects induced the CAB to refuse all applications for new routes — a "route moratorium" as it was called. The Board also approved temporary capacity-limitation agreements among several large carriers to raise load factors, and further restricted scheduling and discount fare competition — a more perfect cartel was being formed in the face of a movement in the opposite direction. A new chairman even believed that these should be made permanent features of regulation!

The first oil crisis gave an excuse for fare increases and even more widespread use of capacity-limiting agreements (such as OPEC production quotas), ostensibly to save fuel. Profit margins recovered somewhat by mid-1974 about the same time the economy was falling into another recession, thanks largely to OPEC. The Board was thus seen as protecting one cartel while the country was suffering from the actions of another. This made it a prime target for change. Critics of regulation also benefitted from a minor scandal involving the Chairman of the Board who wanted to cartelize even further.

The hearings of Senator Kennedy began in February 1975 and provided a widely publicized forum for the economic case against continued regulation of the CAB type. The case was not especially abstruse and its critics had no substantive rebuttal. One of the more telling arguments showed fare differentials on intra-state, non-CAB-regulated carriers in California and Texas that were 50 to 60 percent lower than CAB-regulated fares for comparable distances in otherwise similar circumstances. The cut-rate fares had so raised the load factors for the intra-state carriers that it was highly profitable to charge them. The refusal to sanction rate competition had clearly denied the public the advantage of lower rates. As the Kennedy subcommittee pointed out, Pacific Southwest Airlines "puts 158 seats in a Boeing 727-200 jet aircraft and fills approximately 60 percent of these seats on average. American Airlines puts 121 seats in the same plane and flies it on average 55 percent full. Thus, when flying PSA, 95 passengers must share the cost of flying the airplane, while, on an American plane, 66 passengers must share the same cost."[111] This was something anyone could understand and vividly indicated the benefits of more competition in rates.

In addition the hearings were sprinkled with the arguments that regulation leads to higher investment costs because carriers, unable to compete on price, seek the latest, fastest aircraft for competitive purposes and because of the A-J-W effect.[112] Higher operating costs occur because if the carriers cannot compete on the basis of price they compete on cost-enhancing amenities such as food, drink, movies, advertising, or gimmicks of one kind or another. In addition, other costs of opposing competitors' applications for competing routes or lower fares and the like as well as the trouble and expense involved in seeking permission from the regulatory body to do those things are not required in non-regulated or less-regulated markets. The loss of consumer choices regarding price-quality trade-offs that Freddy Laker was later to dramatize in transatlantic traffic, the extra costs of low load factors because of the failure to allow peak/off-peak pricing and so on were all trotted out and more or less "explained" to a public and a Congress suddenly aware that serious problems existed.

This was all reinforced by the powerful support provided by presidents Ford and Carter who made regulatory reform a major goal of their administrations. Airline deregulation had strong bi-partisan support.

Finally and not the least important were the chairmen of the Board, appointed by President Ford and President Carter. Ford's appointee became convinced that serious regulatory reform was essential. Carter's appointee, Alfred E. Kahn, who had been one of the leaders of the reform movement for years, was the first professional economist ever to serve on the Board. He was an eminent microeconomist and fully dedicated to reducing or eliminating much of the regulatory apparatus clinging to transportation and other industries such as power and communications. He had even written not long before his appointment what has become a classic book entitled aptly *The Economics of Regulation.*[113] Kahn was the right man in the right place at the right time with the right support to persuade not only the Board and its staff, a process already begun before his arrival, but as a witty, energetic spokesman for a cause with a solid analytical and empirical underpinning, he was able to convince many in Congress as well. He enjoyed wide popular support with the press and TV. The message they sent to the public also helped persuade Congress.

Much hard work was yet involved. But with strong bipartisan support from a Republican and a Democratic President and the leading Democratic Senator, legislation was prepared that even the industry, reluctantly to be sure, agreed upon or at least acquiesced to once convinced that some kind of reform was inevitable. In fact, substantial freedom of entry, encouragement of rate discounting and other breaks in the cartel-like arrangements of the previous Boards were instituted before legislation, some of which were of questionable legality. Under the broad terms of reference of the original Act, however, they seemed permissible although inconsistent with past precedents of the Board. Several carriers went to court to protest Kahn's initiatives. Passage of the *Airline Deregulation Act* in October 1978 ended these issues. The most sweeping deregulation bill to be passed up to the present, it was put in place, with several transition phases, one of which included the elimination of the regulatory agency itself, on January 1, 1985. This was the first and only "sunset" provision of any transportation legislation to date.

As far as intercity passenger transportation is concerned, the largest proportion of commercially offered service (some 90 percent of intercity passenger-miles) and the fastest growing segment had been relieved completely of economic regulation. This was accomplished with a speed and thoroughness that was totally unexpected even by those most ardently in its favour. Clearly this reflected not only a set of mutually favourable circumstances, but also recognition that deregulation, or at least regulatory reform, was an idea whose time had come. Just as the 1930s was the hey-day of the rise of regulatory commissions, so the late 1970s represented the time of their demise. This was at once a cheerful and sobering fact and one that haunts supporters at the present, some of whom fear a reverse trend toward some form of re-regulation.

## BUS REGULATORY REFORM

The last of the transportation industries to yield to the reform movement was intercity bus transportation in 1982. The industry itself had none of the glamour of the airlines. Indeed in the U.S. it still has a kind of seedy reputation typified by such stage and movie productions as "Bus Stop." Used primarily by the poor, indigent, aged, students and others unable to afford other means of travel and mainly where rail service is unavailable, it is the poor sister of intercity passenger service. The volume of its business did not change much between 1970 and 1990 for the nation as a whole, and the number of communities where buses once stopped appears to be dwindling rapidly from about 20,000 in 1970 to less than half this amount today.

Its share of intercity passenger-miles, including private automobiles, fell from 2.12 percent to 1.17 percent between 1970 and 1988. For the number of trips with round-trip distances greater than 200 miles, bus was the lowest in a modal split including auto, bus, rail and air in 1977 with less than 3 percent.[114] By virtually any statistic, national bus transportation looms small. Even as a proportion of strictly commercially provided service, it is not large although almost double the rail (Amtrak) share in terms of intercity passenger-miles — 6 percent compared with 3.4 percent for rail.

The ICC regulation never seriously changed the structure of the industry from that which it inherited in 1935 when bus transport was included in the *Motor Carrier Act* without any differentiation from regulations pertaining to trucks. Bus regulatory reform was discussed from the late 1970s on in Congress and elsewhere, but it had none of the flavour and fervour of the debates, hearings and media hype that attended airline and truck reform. Since much of bus transport was intra-state, the previous federal regulations had more limited jurisdiction and impact. Thus the reform bill, the *Bus Regulatory Reform Act of 1982,* contained an amendment to the *Motor Carrier Act of 1980,* which freed up much of the trucking industry from economic regulation that specifically pertained to bus transport. This enjoined the states to cooperate on matters of bus transportation to accomplish the purposes of the Act, established procedures to ensure that this would happen and to prevent nullification by state regulatory actions.[115] Both entry and exit requirements were eased, operating restrictions were removed that placed unnecessary burdens upon interstate commerce, and rate-making freedom, initially within a range and later removed entirely unless shown to be predatory or discriminatory, was granted. The ICC retained authority to make whatever distinctions were needed in defining "unnecessary burdens," "predatory," "discriminatory" etc.; to authorize new entry on fitness grounds only; and most importantly, to be able to overrule state authorities that "unduly" restricted discontinuance of purely intra-state operations.

The results of this Act were something less than dramatic. Greyhound retained its dominance and in fact gained market share for the nation as a whole for its total operations. All carriers took advantage of the easier discontinuance provisions so that the number of stops made, particularly at small towns, dropped sharply. Greyhound has suffered from severe labour problems since the early 1980s but began a system of franchising to reduce costs, increase its scope of operations and improve competitiveness against other bus operators and even other modes, mainly Amtrak.[116] Service reductions throughout the industry do not seem to have been a result of reforms in 1982 since they had been going on for at least seven years prior to the Act. At most "the reform of motor bus regulations accelerated a previously established trend."[117] Even so it is believed that "While intercity bus service has continued to decline nationwide, small communities receiving [Greyhound] franchise service have had relatively constant, or increasing, levels of service during the 1982 to 1986 period. . . . the early experience with franchising is . . . encouraging to those concerned about maintaining bus service to low income and elderly residents of small communities."[118]

Continued labour strife at Greyhound has however clouded the picture especially with respect to profitable private bus service to small communities and within rural areas, thus accentuating their isolation. Numerous local initiatives have been undertaken some with state and federal support and some privately financed by local charities as part of assistance to the indigent and elderly. Major intercity bus traffic has been affected as well but should continue to offer alternatives to Amtrak and, to a lesser extent, private cars and airlines. Any major resurgence of competitive strength however will await future conditions and is highly problematical.

Nevertheless, for the vast majority of small towns and most of the rural areas without air or rail passenger service, service by small or medium-size passenger vehicles at least to the nearest junction with an intercity carrier, probably also bus and Greyhound or one of its franchisees, will be the only alternative. In many cases it will have to be publicly financed.

Regulation of intercity bus service has never been its major problem. Nor can regulatory reform provide much of a solution. Economic forces will decide, and what reform has been implemented thus far will give these more latitude. To the extent that the needed travel by bus is neither for business nor vacation, it will take on the aspects of a social service wherever alternatives are unavailable. Some form of non-user support will then be required, and many ingenious approaches have begun especially at the state and local levels. This implies some form of subsidy beyond the federal system. This also brings up the remaining large problem of direct subsidy to intercity passenger transportation, namely Amtrak.

With the *Bus Regulatory Reform Act* the period of legislative pro-competitive reform at the federal level ended in transportation. The most radical was in the airline industry but major significant changes were related to freight transport which indeed had precipitated the movement. Less complete deregulation occurred in truck and rail freight with the *Motor Carrier Act* and the *Staggers Rail Act*, both enacted in 1980. These two modes, omitting the specialized oil pipelines, accounted for almost 80 percent of intercity ton-miles in 1980. The inland waterways were never significantly subject to economic regulation in the first place nor were contract, exempt and private carriage by truck. Thus, for all intents and purposes, the entire freight industry was permitted to operate under the checks and balances of market forces with few remaining restraints. Certainly they were freer than ever to respond to economic and technological changes pretty much as they saw fit. Yet the ICC was retained as an entity to carry out certain reduced functions according to previous regulation but with new duties under reform. Other less significant industries were also reformed along these lines between 1977 and 1982 such as air cargo, air freight forwarding and household goods.

All commercial passenger service was substantially or completely deregulated by 1982 except for rail. The story of subsequent developments for bus has been noted above. The consequences of airline deregulation are analyzed in Section VI along with developments during the 1980s for intercity rail passenger service. What remains in the present section is a discussion of the development of the Amtrak experiment up to 1980.

## THE CREATION OF AMTRAK: A DEVIATION FROM PRO-COMPETITIVE POLICY?

Rail passenger travel plummeted from 77 percent of all for-hire passenger service in 1929 to barely seven percent in 1970, the last year of rail owned and operated service. Worse was that its regular and large losses were jeopardizing profitable rail freight service. In one sense, relief for the railways from something they had been unable to make profitable and regulation would not allow them to abandon, *increased* their ability to compete in the freight market. Greater freight rate reductions could take place without the need to support passenger service by cross subsidy, and the increased cash flow, without the out-of-pocket loss from the passenger business, would permit greater investment in more efficient freight-carrying capacity. The higher rate of return on assets devoted solely to commodity movement would also attract more capital. All these combined would create the opportunity for rails to compete more effectively with trucks, barges and pipelines over a broader range of goods traffic. In this sense the policy was pro-competitive and consistent with the growing concern with efficiency and market forces.

On the other hand, Amtrak represented a move in the direction of direct subsidy for a service in competition with privately operated, for-profit firms. To be sure, it could be argued that highway users were subsidized indirectly through failure to pay full user-charges for the publicly provided right-of-way. Airlines received a similar indirect subsidy for the airways and airports. These issues were harder to demonstrate certainly in terms of the amount of subsidy each competitor received, especially after the creation of the trust funds into which went some receipts referred to as "user-charges." Nor is it yet clear whether trucks and buses pay either their "fair" share or "efficient" share for their use of the multipurpose highways; similarly with airways. In any event, the subsidy to Amtrak was direct, obvious and politically charged. There was nothing ambiguous about it at all. In this sense, it was *anti-competitive* and non-market determined: hence the question mark in the title of this subsection.

The story of Amtrak and its formation has been well told.[119] It will be briefly summarized here as part of the reform movement or at least one of the major consequences of reform that need to be examined especially in the context of passenger transportation.

As already argued, rail passenger service was taken from the railroads to preserve rail freight service, without much protest! However there were alternatives other than Amtrak. One widely recommended was to let intercity rail passenger service die the natural economic death that seemed to be inevitable if market forces were to prevail, as Hosmer had argued. Another was to reimburse the railroads for the deficits from passenger service and continue as before allowing some abandonment in obviously hopeless cases where "need," not defined in economic terms, seemed to warrant. The government could simply nationalize the passenger component of rail operations or form a quasi-public corporation to do the same thing, but only after paring the service down to what might conceivably become a profitable or break-even service. What finally emerged was the latter — in part because surprisingly strong public protests influenced Congress not to let even the intercity service die. Part of this strong support for retaining something the public did not use very much was undoubtedly the experience of increasing numbers of people with European passenger service and the widespread publicity of the Japanese new technology and operations of the "bullet" trains. The possibilities of new high-speed technologies were also well publicized by projects examined by the government under the *High Speed Ground Transportation Act of 1965*. Thus, many felt it was premature to let rail passenger service disappear. They felt, on the basis of little evidence that the railroads had deliberately discouraged passenger service to be rid of it and that lurking out there somewhere was a technology that could revolutionize the service and make it economically viable. These views are still prevalent today. It was therefore the duty of the government to take the lead in developing such new techniques. If Japan, France and even England can do it, why cannot the U.S.? Some prestige was thus involved in Amtrak's formation. At the same time more legitimate concerns were being expressed concerning environmental consequences of continued predominant reliance upon automobiles and airlines to provide nearly all the intercity travel.

Thus the *Rail Passenger Service Act of 1970* was passed, over the objections of the Council of Economic Advisers which had played some role in the development of the economic case for transport deregulation. There were other objections but President Nixon signed the bill without much apparent enthusiasm. He was reported to have been undecided whether or not to veto the bill up to the moment of signing.

The Act declared that rail passenger service was a "necessary part of a balanced transportation system" and therefore should be preserved. Furthermore it provided more freedom of choice and would help to alleviate highway and airport congestion. A separate corporation was created, the National Railroad Passenger Corporation, (later known as Amtrak) which explicitly was not an agency or establishment of the U.S. government but rather a private, for-profit corporation supported by the government.[120] The

Act required a basic system to be established in short order. Service beyond the basic system could be provided if deemed "prudent" or if a state, local or regional government body requested it and was willing to bear two thirds of the losses.

Amtrak contracted with the railroads to relieve them of passenger service in return for payments based upon each road's 1969 passenger deficit. With equipment from the railroads as part of their payment, some cash from the government and the railroads too, as well as a basic plan that pleased no one, operations started under new management, so to speak, on May 1, 1971. Nearly half of the passenger trains in existence previously had been dropped, the "basic" system was national in scope — even connecting points where traffic potential was minimal — and the retention of many trains was due to political pressure. Operating with former railroad equipment 21 years old on average, relying on the railroads to actually run the trains under contracts which provided no incentives to give decent service and using the former railroad personnel unable to perform efficiently before, it is scarcely to be wondered that things did not go well. Table 4 summarizes the operating results through 1980.

*Table 4*

*SELECTED AMTRAK OPERATING STATISTICS, 1971-1980*

| Year | Revenue passengers carried (millions) | Revenue passenger-miles (billions) | Deficit ($ million) |
|---|---|---|---|
| 1971[a] | 10.6 | 2.0 | 55 |
| 1972 | 16.6 | 3.0 | 148 |
| 1973 | 17.0 | 3.8 | 159 |
| 1974 | 18.3 | 4.3 | 273 |
| 1975 | 17.4 | 3.9 | 352 |
| 1976 | 18.2 | 4.1 | 441 |
| 1977 | 19.0 | 4.2 | 552 |
| 1978 | 19.2 | 4.2 | 582 |
| 1979 | 21.5 | 4.9 | 595 |
| 1980 | 20.8 | 4.5 | 599 |

**Source:** **Annual reports of Amtrak, 1971–1983; also, Association of American Railroads, *Railroad Facts* (Washington, D.C.: the Association, 1983), p. 61.**

[a] **Reflects operations for the period from May 1 to December 31, 1971**

To say the very least, the results are unimpressive. Comparison with the late 1960s and 1980 indicates the number of passengers to be barely one fourteenth, the number of passenger-miles, one third of those pertaining some 12 years earlier whereas the deficit is almost 50 percent higher. To be sure, the number of trains have been slashed but not nearly proportionate to the traffic reductions. The higher deficit, even considering inflationary levels, was still worrisome because revenues and costs should have risen no more than equally. Indeed with any improvement in efficiency and rational pricing, the gap between the two might well have fallen. Even with all the caveats, the service continued to be dismal during most of this period.

Yet there were several favourable signs. New equipment began to replace the antiquated materials foisted upon the Corporation in the first years. This equipment was less subject to breakdown, easier and cheaper to maintain and more fuel efficient. The first oil shock in late 1973 and the vigorous campaign to conserve gasoline and use public conveyances doubtless contributed to the ridership spurt in 1974 and again in the second oil crisis invoiving the Iranian revolution in 1978 which caused oil prices to more than double again. This added to the argument that the fuel efficiency of rail passenger transport was probably worth preserving in an environment of continually rising fuel costs, a proposition that was not disproved until the recessions of 1981-83. Finally, in 1976, the 4R Act gave the Northeast Corridor Boston-Washington main line and several branch lines to Amtrak. With its first ownership of right-of-way, it could provide its own service without contracting with the railroads and could improve the road bed to accommodate higher speed trains. Indeed the 4R Act mandated such improvements and ordered reduction in trip times as well. The Acts pertaining to Amtrak of 1978 through 1980 saw greater concern for cost control, elimination of under-used capacity and worry about the effects of subsidized Amtrak on bus operations. Goals were set to improve on-time performance, raise the average speed of the whole system, increase the ratio of revenues to operating costs at least to 55 percent by the end of fiscal year 1985 and in general to shape up.

In 1980 the newly elected Reagan administration was expectedly hostile to anything smacking of subsidy and openly attacked Amtrak's high visibility in this regard. After almost a decade of operations, Amtrak had gone from a situation where little was expected of it to one where nothing was expected of it. Yet the annual subsidies continued to mount. Hosmer was looking better all the time.

## TWO STUDIES REGARDING THE U.S. TRANSPORTATION SYSTEM IN THE LATE 1970s

Concern over Amtrak led to the hope that perhaps the situation could improve if there were better coordination between rail and bus passenger transport. Coordination is a word used so often as a goal of policy that it ceases to be much more than a pious hope, especially in a system that has from the outset insisted upon separation of modal ownership. Nevertheless, the DOT was asked to report on just such a possibility. The report, entitled *Report on the Potential for Integrating Rail Service Provided by the National Railroad Passenger Corporation with Other Modes,* appeared in 1976 and answered with a resounding "No."

The reasons given for such a negative conclusion reside in the barriers to cooperative integrated service, the most important of which is the inherent antagonism between the two modes. Most bus operators, especially those providing parallel service with Amtrak over at least some of their routes, view Amtrak with suspicion and as an unworthy subsidized competitor. There was little desire, at least at the time of the Report, for closer relations between the two modes.

There are of course inherent reasons why intermodal public transportation "involves an added degree of passenger inconvenience when compared to single mode travel."[121] The added inconvenience arises because the intermodal traveller is usually required to "(1) change stations; (2) endure lengthy layovers as a result of poor connecting schedules; (3) purchase separate sets of tickets; (4) transfer baggage; and (5) seek schedule information from multiple sources."[122] The Report examined each of these in the context of Amtrak-bus relations, institutions and attitudes. Without going into any details, suffice it to say that the Report found the sum total of these problems virtually insurmountable and the expected traffic potential so limited even if they were overcome, that the effort and added costs were scarcely worthwhile. This conclusion is relatively easy to accept even though there are clearly specific situations where such coordination is possible and economically feasible. There appear not, however, to be very many of them.

The second report is far more substantive and comprehensive. This study, entitled *National Transportation Policies Through the Year 2000,* was commissioned by Congress in 1976 and directed to conduct "a full and complete investigation and study of the transportation needs and of the resources, requirements, and policies of the United States to meet such expected needs."[123] To implement the mandate, a National Transportation Study Commission was established, consisting of 18 members (and nine "former members") of which eight were businessmen and the remainder Congressmen or former Congressmen. A large staff was assembled whose findings were subject to approval by the Commission as were the details of the final Report. The chairman noted that the recommendations were approved unanimously by the 18 members.

The timing of the Report was unfortunate since it overlapped the period of most rapid introduction of new legislation, 1976-1979, when it appeared. It was therefore unable to influence the legislation nor did it have the advantage of knowing what kind of legislation would emerge with which it could agree or disagree, except for the airlines. It is lengthy, loaded with data and analysis based upon considerable sponsored research.

Its analysis of transport "needs" required future projections of the state of the economy starting with base year data for 1975 and ending in 2000. Much activity was devoted to estimating the economy and the associated transport levels at that time. From this were deduced the needs which more or less became confined to capital requirements and the policy changes in some sense "necessary" to accommodate the estimated needs. Since the relationships between the state of the future economy, the number of associated ton- and passenger-miles and the capital plus policy changes essential to ensure achievement of the projected transport output are not amenable to quantification without some pretty heroic assumptions, the Report reverted to much descriptive material. When it came to numerical estimation, a lot was left to be desired regarding methodology, data and the (usually) implicit relationship between the end results and the needed transportation resource inputs (capital and energy). The subjectivity reached even higher levels in relation to the linkages between the (over 80!) specific policy changes from the so-called *status quo* situation (itself then undergoing rapid change). Somehow each recommendation was presumably necessary to produce the needed transportation services of all kinds. Such recommendations referred to government organization, economic regulation, non-economic regulation, ownership patterns, financing, pricing, taxation, planning and information, the fuel situation (prior to the second oil crisis in 1979) and so on.

While the scenarios were reasonable enough (mainly the low-growth scenario as far as real GNP, population and labour force were concerned through 1985), the use of the material and its enormous scope made much of the discussion either overly descriptive (though not uninteresting), facile, inconsistent or tedious. The research papers contain better and more useful analysis. The attempt to put them all together in a single, even lengthy volume does not come off.

For what it is worth, the policy recommendations come down squarely in the middle of what was then occurring in the economic policy realm — namely, more reliance upon market forces and free enterprise but with a new super commission to include the ICC, the CAB (soon to disappear) and the Federal Maritime Commission (FMC). Few could disagree with the conclusion that "Over the long term, complete revision of existing Federal economic regulation of transportation should be accomplished. Revisions should be undertaken following careful but expeditious economic analysis of their consequences along with assurances that protect the public from possible adverse effects implicit in such revisions. Basically, such revisions should encourage efficiencies in operation and energy consumption and provide wider latitude in entry, exit, route choice, price, and quality of service by permitting firms to make their own decisions subject to general laws and rules designed to protect the public interest, such as energy conservation legislation, antitrust laws and insurance coverage. Transportation firms should be permitted to merge, however, subject to the same antitrust policy concepts as other sectors of industry, as a minimum, once regulatory reform is implemented. In applying antitrust policies, consideration is necessary for the interconnected, international, and interrelated nature of the transportation industry."[124]

The Report was something of a disappointment but it did reflect the mood of being between two policy regimes. It had the main thrust right but worried too much about how to get from where we were in 1976 to where we, in some sense, were projected to be, equated here with where we *ought* to be, by the year 2000.

## 6. A DECADE OF EXPERIENCE UNDER REFORM

The last year of major legislative change was 1982 when bus transportation was granted more economic freedom from federal regulations. No new reforms along these lines have been made since possibly because, aside from Amtrak, there was not much left to do in transportation regulation at the federal level. To be sure, the ICC was left with some new duties and reinterpretation of old ones but in intercity passenger transportation it had few remaining duties or authority of much consequence. The CAB was gone by 1985 and had few functions left except for winding down. Thus, aside from water carriage, ferry service and other aspects of state and local intercity travel, economic regulation had been "reformed" along pro-competitive lines.

There are two main questions to pursue in this section as we bring the story up to date. One is, what have been the consequences of regulatory reform for air traffic? We have already noted the situation with respect to buses. And Amtrak was not reformed, it was created, but we will examine what has happened to it as well. The second question is, depending upon the answers to the first, what should the federal government do next with respect to the transportation industries? We have some clues from the DOT's statement of policy in 1990, but the issues remain of what more or less needs to be done in the interests of efficiency including problems of externalities involving safety and the environment, as well as user-charges.

## THE AIRLINES AFTER DEREGULATION

Even before the *Airline Deregulation Act* was passed late in 1978, the experiment in decontrol had begun in earnest under Kahn and to a lesser extent his predecessor. Fare discounts were not only allowed without the usual regulatory fuss but actively encouraged. Discount fever swept the industry. Over half the total fares were subject to discount by the summer of 1978. As a result, load factors jumped on average almost 10 percent from 55.5 to 60.7 percent for the year ending September 1978. Carrier profits nearly doubled over the same period. The demand elasticity had been effectively probed under competitive pricing and it had worked. The formal deregulation Act was passed in October of 1978 partly because of such effects although the votes were there before these results were in.

This auspicious beginning was not to last. The next year witnessed the second oil crisis with fuel costs doubling. Price competition intensified and new entrants appeared in many city-pair markets. The general fare level rose but not due to deregulation — or so several early studies concluded. In fact, the fare discounts and out-and-out price competition maintained traffic quite well. The recessions of the early 1980s, associated with attempts to resolve the supply-side oil shock by stringent monetary policy alone, reduced air traffic demand and led to several bankruptcies of note (Braniff and Continental) and some of the new entrants did not survive. Overall losses occurred in 1980, 1981 and 1982, but as the economy revived in 1983 and began its long period of growth that ended in mid-1990, the domestic airline industry performed quite well. Competition in most markets intensified.

On a national basis there was a return to relatively high levels of concentration as mergers and bankruptcies continued, but market concentration route by route decreased on average in markets of all sizes and dimensions.[125] Recent results (July 1991) show 6 of the 12 largest carriers in bankruptcy. Four of these have filed since December 1990 and one, Eastern, has since ceased operations. Concentration at the aggregative level has potentially increased over the last year by a substantial amount depending upon how the bankruptcies are resolved. Except for Eastern, the current situation has not changed much since the other carriers are still operating and two of them, Pan Am and TWA, have mostly been in international business, which remains highly cartelized. The announced recovery from the recession that began in the summer of 1990 may ease the situation if more vigorous growth occurs than anticipated at present writing (July 1991).

However, most of the evidence up to the present shows that competitive forces are working generally as expected in the airline industry; namely, fares are more volatile in response to changes in supply and demand conditions; there have been more bankruptcies which is the normal process by which excess capacity or managerial ineptitude become resolved, reduced or eliminated in competitive markets; and a closer coincidence between rates and costs in specific situations has been achieved, although the evidence here is mixed.

At the same time there are certain other problems beyond those associated with recent bankruptcies. Price discrimination has apparently increased. Service quality overall has decreased as manifest by the increase in airport congestion which causes takeoff and landing delays. There is an increased sense of crowding aboard most flights as a result of fare discounting and the reduction in excess capacity through higher load factors which have been sustained above the 60 percent level in the late 1980s.

Some of these results are beneficial to most passengers. The enthusiastic response to rate reductions — even discriminatory ones — has helped fill up aircraft to a greater extent than before. For some, the crowding effect is unpleasant and they would be willing to pay more to have more space. To a limited extent this option is available with different classes of service (e.g. business, first class, etc.) but not always. It is doubtful that this inconvenience constitutes enough disutility to suggest that there are no overall net benefits. Kahn gives some evidence to this effect.[126] The increase in load factors is however more efficient and permits lower fares as was intended. The overall improvement in resource allocation is to be commended even if not a totally unmixed blessing.

The increased delays occasioned by the enormous traffic growth since deregulation, itself a function of competitive pricing due to contestability that produced lower fares on average and sharp discounts at specific times in particular markets, is related to the federal government's failure to encourage more airport construction at the state and local level or become more involved itself. Certainly there is no excuse for having supported a policy change that was expected to stimulate the use of excess capacity and to encourage the expansion and use of additional capacity in aircraft, and then not to have accommodated this with commensurate expansion of airway facilities which, from the beginning, have been a federal government responsibility. The excuse of budget deficits is a sham since such outlays are investments. The fact that no new major airport has been constructed since Dallas-Fort Worth in 1974, well over 15 years ago, suggests the source of congestion delay. This may now be on the way to correction but it is very late in the day. Rather than reflecting adversely on the wisdom of deregulation, increased traffic (the cause of congestion) reflects favourably on deregulation. The lack of facilities reflects mostly on the lack of vision of government transport investment policies.

The intensification of price discrimination is more worrisome. In part it reflects the continued concentration in some submarkets and the new dominance of certain major hub airports for the increasingly popular hub-and-spoke system by one or two major carriers. This is partly related to the failure of the federal government to enforce the antitrust laws thereby permitting a degree of concentration that would otherwise not have occurred. This failure was a deliberate part of the Reagan administration's policy of virtually ignoring antitrust enforcement during most of the 1980s as an aspect of extreme *laissez-faire* and the belief that "government was the problem." As Kahn puts it, "the government clearly has neglected responsibilities of which it was never the intention of deregulation to relieve it."[127] This also applies to airway and airport capacity and enforcement of safety practices, including the failure to replace all the air traffic controllers fired in the early 1980s despite the large traffic and congestion growth.

The issue of discrimination is also, and perhaps mainly, due to the ability, through control of sophisticated computer reservation systems, to take advantage of varying degrees of monopoly power on specific routes to engage in "yield management" — which is a euphemism for trying to maximize net profits from each seat-mile on each flight. With profit limitation and/or *some* greater degree of competitive pressure, differential mark-ups over marginal cost are both essential and efficient, as Ramsey pricing theory indicates. It would be folly to deny it to the airlines when the *Staggers Rail Act*, which "reformed" the rail freight industry, virtually mandates such pricing in the interests of revenue adequacy. Yet the extent of such deviations from costs and the failure of the fare structures to pay attention to distance bothers many people. Vastly different fares for the same flight and service reinforce concerns about "fairness" or apparent equity. The original *Act to Regulate Commerce* arose out of just this kind of emotional response to long- and short-haul railroad pricing. At some point there is a trade-off between equity and efficiency, especially where the degree of fare differentials becomes so wide that it induces a customer backlash that could lead to some re-regulation however much economists may justify Ramsey pricing. It simply does not seem fair. The encouragement of more open access to computer reservations systems, more vigorous antitrust activity and expanded capacity of the infrastructure to attract competitive challenges to hub-dominance, might alleviate the extent of discontent and prevent more drastic re-regulation.

All things considered, airline deregulation has been at least a qualified success. The industry is certainly more competitive and efficient than it was. The benefits of improved efficiency have been distributed widely if unequally. There is little evidence of monopoly profits. Most other industries with these features would be let alone or tolerated for the degree of market concentration, industry practices and results that have thus far typified the airlines. Furthermore the prospects of even more competition from foreign airlines are promising. An "open skies" policy in Europe, scheduled for 1993, could be matched by a similar policy in North America. The U.S. Secretary of Transportation is reported to have said that "America and Europe will one day negotiate a deal to allow their carriers completely free access to each other's markets."[128] It is therefore much too early to talk about reversing the past 13 years of substantial economic freedom in the U.S. airline market despite some real and potential problems none of which require major deviations from the promising trends already established. The federal government however must change its stance toward airport and airway capacity and efficient pricing thereof and more rigorously enforce antitrust laws. It should also support open-skies policies. Eternal vigilance is the price of maintaining competition. It is also worth it.

## AMTRAK IN THE 1980s

One might wish that the intercity rail passenger transportation problem had been as well resolved as that of the airlines. Unfortunately this is not true although there are signs of improvement.

Since 1980 the number of passengers has risen less than 10 percent and passenger-miles about one third. The federal subsidy is estimated for 1992 to be about what it was 12 years ago but one third less than its peak of almost $900 million in 1981. In short, it has shown traffic growth far below airlines, but above intercity buses and little reduction in the amounts required from the government. It still plays a minuscule role as a *national* carrier but is much more significant in the Northeast corridor where it carries about one third of the combined rail and air passenger traffic. Even here the proportion falls sharply to less than two percent if bus and automobile intercity traffic is included. After 20 years one cannot say that Amtrak has not lived up to the limited ambitions as envisaged by its supporters.[129] But it has done little more than hold its own if we discount, as is only fair, the initial five years as experimenting with inadequate equipment, despondent personnel and more than the usual start-up problems. It is clearly not a national carrier as over half of its business is done along the Northeast corridor.

As a short-term measure to relieve the railroads of their losing passenger service and at least salvage the freight business, it has been successful. As an experiment to see whether *traditional* rail intercity passenger service has a future on a national scale it has failed. It is clearly of some consequence in the Northeast and perhaps has a chance in several other corridors but that seems unlikely. The existing technology has few prospects as either a major player along the limited number of high-density corridors or, more certainly, as a national entity serving hundreds of communities and cities, as is being attempted now. Indeed it is probably obsolete even as an important aspect of any specific high-density corridors. For these, there are the options of the higher technology that has long been in use in Japan and France and new technologies being developed such as magnetic levitation (maglev) and others.

High-speed trains "are an entirely new mode of transportation".[130] They run on exclusive rights-of-way, using different power systems and can achieve speeds of up to 300 miles per hour (mph). Amtrak's top speed is only 125 mph between New York and Washington, D.C., and this only after a $2.3 billion investment in track upgradings, removal of all grade crossings, introduction of electric locomotives and improved signal and communication systems.[131] Maglev techniques even by-pass the historic "flanged steel wheels on steel rails" which virtually defined the railroad concept. Not only is this a new technology but it is one that is changing rapidly. So far as one can see, Amtrak is unlikely to be involved with it in any meaningful way. In fact separate states have been examining these alternatives for up to ten years largely independently of Amtrak. They include Texas, California, Pennsylvania, as well as consortia of states such as the Midwest High Speed Rail Compact, the Coalition of Northeastern Governors. The apparent success of the TGV in France and the Shinkansen in Japan and the prospects of the recently opened German Inter-City Express on May 29, 1991 with maximum speeds above 175 mph and potentials above 200 mph have stimulated renewed interest in North America, although it may have much more limited application than in Japan and Europe.

There are several reasons for this. In the first place, distances between major urban centres, or areas where high-density corridors are possible, are much greater in North America than in Europe and Japan. If the competitive range for high-speed ground transport is taken as between 150 and 500 miles and requires a ridership of about six million passengers per year to break even, given the most likely combination of fare and cost level, there is only one corridor in the U.S. now generating that number of passengers by air (Los Angeles-San Francisco) and only four expected by the year 2010. Any high-speed ground transportation system would have to capture all of the existing air traffic and/or a substantial portion of air plus automobile and bus traffic to be economically viable. Given the likelihood that speed, capacity, comfort and efficiency improvements would be occurring in the competitive modes as well through the year 2010, the chances of any large-scale, unsubsidized, rail intercity high-speed operations seem slender indeed.

Secondly, the European and Japanese systems originated in heavily travelled rail corridors that were approaching capacity and could therefore build incrementally upon a system that had already achieved relatively high speeds.

Thirdly, the systems in Europe and Japan were far more fully integrated into a national system of conventional rail and terminal networks for passengers which no longer exists in the U.S. to anywhere near the same extent.

Finally, the relative dependence upon rail for intercity travel was far greater in Europe and Japan than in the U.S. when the former began investing heavily in high-speed rail facilities. In fact, in the U.S. rail intercity passenger traffic was dropping rapidly and with it any major concern for its maintenance given the comparative advantage of automobiles and airplanes in the U.S. with relatively low fuel prices and ubiquitous highways and airways priced at less than full costs to users.

For all these reasons, the technologies for high-speed rail passenger traffic were developed and introduced far earlier elsewhere, Japan in 1964 and France in 1981 for the actual beginning of revenue service. Any transference of them to the U.S. will have to face up to substantially different circumstances here and to the historic policy of modal independence. There is simply no national constituency for implementing an almost wholly new transportation system that would compete effectively without a heavy infusion or commitment of federal resources at least to supplement state, local and private finance, and far more support than implicit in *Moving America* (see next subsection).

Amtrak seems remote from such considerations and federal involvement is not great yet since, except in the Northeast, the systems thus far envisaged are almost entirely intra-state. They are also enormously expensive. However, the TGV reports, up through 1985, internal rates of return for the Southeast system of "15% for the French Railroads and 30% for the community as a whole."[132] A recent study by U.S. DOT relating specifically to maglev technology concludes that "it will be economically feasible to construct a limited number of commercial maglev systems in the United States, starting in this decade."[133] This is only for a limited number of route-miles and, except for the costs involved (about $50 billion), remind one of the early turnpike roads. Most reports are less optimistic about economic feasibility.

This is all highly speculative. As it pertains to Amtrak, however, it suggests that either its operations should be confined to the Northeast corridor and the track there upgraded to achieve significantly higher speeds using newer already proven technology (maglev is of course premature) or the experiment be wound down. If the only reason for keeping it going is that the value of the assets at liquidation would be far less than the obligations of the Corporation and thus the government would become a payer of last resort at an expense greater than the current subsidy, as implied by Tobey,[134] then the time has surely come to end it as gracefully, quickly and expeditiously as possible before even more capital commitments are made.

There may however be efficiency reasons for continuing at least portions of the Amtrak experiment. A recent route-specific analysis of Amtrak's operations, based upon a disaggregate intercity passenger demand model for 1977 calculated a measure of net social benefits (NSB). It concluded that "government subsidy may be economically justified on dense short-haul routes like those found in the northeast corridor, but subsidizing long-haul and low-density routes cannot be justified using economic efficiency arguments."[135] In fact the net social benefits are positive for the whole operation but only because of the huge net benefits from the Northeast corridor. One can, of course, quarrel with the demand model employed, the data available and the method used to calculate NSB. However the general findings seem reasonable enough and the whole approach, even with the acknowledged qualifications, verify earlier conclusions that the "benefit offered by rail travel is greatest on short routes between large cities where the primary beneficiaries are business travellers."[136]

Though the system may not be financially viable, the efficiency criterion requires only positive NSB, although some of the social benefits could be captured on selected routes through some variant of Ramsey pricing to reduce the specific financial subsidy. This combined with continued improvements in cost effectiveness and productivity could turn the Northeast corridor into a financially break-even operation. If Amtrak is viewed as a basic *national* rail passenger system, then financial viability and net social benefits are reduced. Few network economies or benefits exist in the sense that most of the routes outside of the Northeast corridor do not feed much traffic into it nor provide contributions to joint or common costs.

The experiment attempting to create a *national* system has not succeeded and shows little prospect of much improvement. As with the railroads and passenger service, a decent effort was made but to no avail. It should be stressed that ending Amtrak does not preclude development of high-speed rail in the U.S. along specific corridors. Indeed, that appears likely within the next decade. It will not however bear much relationship to Amtrak as originally conceived and thus far executed except for the Northeast corridor.

## THE LATEST NATIONAL POLICY REPORT

In February 1990, the Secretary of Transportation released the most recent statement of transportation policy under the title *Moving America, New Directions, New Opportunities.*[137] This is based on several assumptions. First that the basic U.S. transportation infrastructure is complete in the sense that massive extensions of it are no longer necessary nor, with few exceptions, would they prove to be economically feasible. The system is mature. It needs lots of work however because of inadequate maintenance and increasing capacity constraints. It is now more important not only to maintain the system but to use it more efficiently. Indeed economic and efficiency criteria are everywhere in evidence throughout this Report. Thus, the way to use the infrastructure more efficiently is through sensible pricing. This covers a host of possibilities including peak/off-peak pricing, cost-based pricing including full user-charges for use of publicly provided facilities including externalities, elimination of subsidy, modal coordination, modal equity of treatment among modes and so on. New technologies are emphasized including high-speed rail, intelligent vehicle/highway systems, research to create and disseminate new technologies and demonstration projects for new techniques. To improve efficiency, intermodal equity and allocation within transportation, the remnants of economic regulation of rail and truck freight transportation are to be removed. As far as this Report is concerned, the regulatory reform movement has not only been successful but is continuing. Even freer markets and more of them are sought in transportation.

As would be expected, safety and defence needs are emphasized, but couched in terms that are not inconsistent with efficiency criteria, namely that, given the goals, they are to be achieved by least-cost techniques. Even the size of the estimated defence needs will be scrutinized to minimize negative economic impacts.

Another main assumption underlying the Report is that the federal role should be limited in various ways. Federal funding will be available only to projects of truly "national significance."[138] Furthermore, "the increased responsibilities and capabilities of the State and local and private sector partners" must be recognized.[139] This applies not only to maintenance but to other projects as well. Greater use must be made of user-charges and innovative financing techniques by state and local governments and the private sector. "There is widespread recognition that the United States will need to rely more on the private sector to finance facilities and services in virtually every area of transportation . . . [G]reater use of innovative financing approaches, including private financing initiatives and joint ventures by private companies and State and local governments"[140] should be encouraged. "State and local governments have already assumed greater responsibility in transportation. This can and should continue."[141]

Along with reduced largesse, the federal government will relax constraints upon how the reduced funding may be used by the state and local authorities. "It is Federal transportation policy to . . . move toward greater flexibility in use of transportation funds at all levels of government for facilities that enhance access and improve connections."[142]

The limitation on the federal role in finance will however be partially offset by activities that enable state and local governments as well as the private sector to plan and allocate resources, wherever or however derived, more effectively and especially where they fill gaps in the national system.[143] Federal outlays will also be increased to assist "research and technology projects" in a wide variety of ways such as providing seed money, maintaining a knowledge base, promoting "adoption of new technologies"[144] and so on.

In short, beyond the reduction of federal activities already implicit in the deregulation that has occurred since 1976, further reductions will take place in the funding of new transportation assets even though future needs will be substantial. The federal role will be more one of monitoring resource use, assisting in various ways to enable others to tap financial resources and use them effectively, promoting innovations, education and competition in transportation and, in general, playing a mostly hands-off, chairman-of-the-board type of function. This contrasts with the previous role since the Great Depression when vast amounts were paid for highways, airways and other aspects of the infrastructure to say nothing of the outlays for the several regulatory commissions. In a sense, the federal government is putting the states, local governments and the private sector on notice that the big job of infrastructure building is done. It is up to them to maintain and manage it properly.

The federal government will assist with gap closing, maybe some infrastructure extension but mostly with supervision and some managerial help. This has been referred to as "a vision of federal policy that is narrowing, retrenching, retiring."[145] It is also probably true that this withdrawal is a recognition of the enormous costs in money, accidents, environmental and aesthetic degradation occasioned by much of the economic regulation and infrastructure building of the past century and a half or longer. One suspects that it is mainly motivated by the federal budget situation. Even so, it is a reasonable retreat. Market forces are doubtless better users of the facilities than regulation and there is little doubt that much excess capacity exists throughout the system's right-of-way, despite serious congestion in some areas. Proper pricing and some efficiently conceived new capacity will probably suffice for the next decade or so especially if bolstered by new technologies that are not outrageously costly. We have come full circle from the days when the federal government was reluctant to spend anything on transport right-of-way except for projects of "truly national importance" and left most of the regulation and investments in transportation to the states and local communities, through the activist period when the opposite applied, to 1990 and back to *Moving America*.

## THE UNFINISHED BUSINESS OF REGULATORY REFORM

The unfinished business of economic reform of intercity passenger transportation involves a package of at least three major ingredients: first, a more conscientious effort to price publicly provided infrastructure more effectively and consistently across modes so that competition can play its role in the passenger business. Second, from the very beginning, there should have been a moratorium on mergers, except for the most compelling cases of, for example, inevitable bankruptcy or termination of an active competitor in order to maintain as many traveller options between city-pairs as possible and, hence, give competition and market forces a real chance to see how effectively they can work. Finally the regulatory authority needed to be stripped of all powers to prevent freedom of exit and entry and to price in any way the firms saw fit so long as no antitrust laws were violated. In essence, treat the ICC just as the CAB was treated.

This was not done in intercity surface passenger transportation. In a real sense the experiment in regulatory reform was not allowed to work out with respect to passenger traffic as it was with respect to freight. Perhaps this relates to the fundamental differences between the two markets noted earlier: moving people requires a higher degree of manifest public concern for safety, comfort and convenience than does moving things. Market forces are not to be trusted to the same extent where people are involved. The failure to allow market forces to determine the quality, quantity and price of intercity rail transport reflects this approach which surprisingly did not emerge with respect to air transport. Thus, other factors must be at work.

## BEYOND REGULATORY REFORM

Among these other factors are the new priorities which began to emerge in transportation policy even before the first deregulation bills were passed. Protection of the environment, transportation safety, energy use and urban sprawl were issues that preceded regulatory reform and remain even more urgent today, especially as the U.S. Congress debates what has been called the "first major overhaul of the federal transportation system in 35 years."[146] Part of the rationale for Amtrak was that rail intercity passenger travel was more fuel efficient, safer and less polluting than automobiles or airplanes. Thus there would be substantial external benefits to a more extensive use of railways which would more than justify the meagre subsidy. It was also believed that autos and planes were heavily subsidized in many different ways most evident through inadequate user-charges and uneconomically low fuel prices which encouraged excessive use of scarce fossil fuels, created congestion, pollution and suburban sprawl and caused more deaths and injuries. Thus the highway and airway ages were seen by some as artificial creations of a public policy that has warped the outcome against alternatives such as railroads and buses, both of which could move the same number of passenger-miles at incredibly lower real "costs" in all of these dimensions.

There is, in all this, no recognition of the value to the user of the enormous quality differences among the modes which is especially important in passenger transportation compared with freight. A ton-mile of cargo moved by rail or truck may not differ much from some shippers' point of view but a passenger-mile by bus, Amtrak or TWA has a huge difference in "value" as average passenger fare differentials suggest. Demand considerations cannot validly be neglected in efficiency determination as the centrally planned economies learned the hard way. Again, this type of thinking about efficiency only in relative cost terms is partly a product of the failure to distinguish between freight and passenger transportation.

The environmental concerns however highlight the need for a more careful examination of user-charges, including amounts necessary to compensate for congestion and pollution. This is no easy task. Yet the importance of efforts to do the best possible even with the existing inadequate information cannot be over-stressed. In addition, it would be worth considerable investment of resources and efforts to obtain information to enable more reasonable estimates of the full costs, including the externalities, of private and commercial use of the highways and airways, by vehicle and plane type, and assess these accordingly. It is doubtful that this would significantly change the modal composition of travel demand but it would provide a substantial incentive to automobile, truck and aircraft producers to enhance fuel efficiency, develop alternative fuels and reduce pollutants. This would also improve the performance of markets in achieving a true least-cost outcome in the economic sense. In fact this was what the regulatory reform movement was all about in the first place. It required full user-charges and maintenance of traveller modal and intermodal options for the effective functioning of commercial transportation markets freed from economic regulation. This was seldom made explicit. As a consequence, maximum efficiency has not yet been realized in the case of intercity passengers.

The most recent concern is about growing congestion of certain major areas of the highway and airway systems. However, these apply mainly to selected airports and to highways in and around major cities. There is plenty of excess capacity elsewhere in the intercity rights-of-way beyond the urban confines. Yet there are plenty of reasons for concern for intercity transportation as well. Most intercity travel originates or terminates at an urban centre or airport hub where congestion is likely to become increasingly severe. Up to now, the approach has been to build more physical capacity. But there is now more opposition to this for safety reasons, because of excessive costs in already built-up areas, pollution concerns including noise, visual pollution as well as noxious emissions and others. No new major airport has been completed since 1974 in part because of strong community opposition — the NIMBY (not-in-my-backyard) effect. Paving more urban freeways or by-passes runs into similar opposition and when they do get built usually only arrest congestion for a short time. The effort is now focussed on how to get more transportation out of the roads we have already built. "We have poured enough concrete," as Senator Moynihan vividly proclaimed in the context of the pending highway bill.[147] Indeed, using the existing infrastructure more efficiently is one of the goals of regulatory reform. It also requires full user-charges, time-of-day pricing and other schemes already noted. These also apply to the *urban* air and highway networks along with many other necessary measures to ameliorate the so-called urban problems.

Thus the emphasis upon improved maintenance and more efficient use of the existing infrastructure makes special sense at the current juncture. It will however take much more than simply eliminating the kind of economic regulation that involved the ICC and CAB and placing blind reliance upon even competitive market forces, important as these may be. The role of the federal government in intercity passenger transportation is far from over. Indeed, it may increase sharply if high-speed ground transportation is to proceed much further. Ironically the role will shift from deregulation of air and bus service to promotion of some "rail" (higher speed, of course) intercity travel, the shrinking and confining of Amtrak to the Northeast corridor and the more active promotion of competition within the air and bus industries.

## EFFICIENT INFRASTRUCTURE PRICING: HIGHWAY USER-CHARGES

More than deregulation and greater reliance upon competitive market forces are needed to improve transport efficiency and performance. It is the duty of government to ensure that most if not all transport markets are and remain competitive, contestable and, in the economic sense, "free." There is little point in substituting a private for a public monopoly if one cares about "the public interest." Constant efforts are required from these agencies of government concerned with antitrust or anti-combines policies to ensure free, open and contestable markets in the transport sector following regulatory reform. But even free markets are not enough. Since much of transport infrastructure is publicly provided, no automatic, free market mechanism will ensure that it will be efficiently priced to its users, the providers of transport services whether public or private. Thus efficient infrastructure pricing is equivalent in importance to deregulation and maintenance of competition if we seek efficiency of production and consumption in transportation.

The favourable economic outcomes resulting from a largely pro-competitive market, require that suppliers of passenger services pay the full costs borne by society in producing such outputs. The marginal social costs of production is the "price" that needs to be charged for all goods and services, including those of publicly provided infrastructure.

In all areas of production, there are problems in measuring precisely what constitutes marginal social or even marginal private costs. Where externalities are involved, the difficulties of measurement are substantially increased. In transportation the situation is further complicated because much of the infrastructure is publicly provided, maintained or improved from its natural state as in the case of waterways and ports. The "services" of such infrastructure are not only hard to define, but difficult to cost and hence to price properly, whether used for commercial or own-account purposes. The fact that some modes (e.g. rail and pipelines) own their own right-of-way and must somehow price it correctly in the product sold, does not solve the problem; it merely changes the locus of responsibility for doing it.

Within the entire transportation industry, including passenger and freight commercial and non-commercial, a set of at least reasonably plausible cost-occasioned user-charges is indispensable. Yet few attempts have been made to develop such estimates or even to build, maintain and finance highways using efficiency criteria as at least part of the input. It is thus difficult to establish whether particular highway user-groups pay either their fair or an efficient share of the total costs of the highway system, although various partial studies in both Canada and the U.S. tentatively have concluded that heavy trucks seem to pay less in user-charges than the costs they occasion, while passenger cars and buses pay more. But without improved estimates, data and methods even this tepid statement is largely guesswork.

More attention has not been paid to this important aspect of efficiency for many reasons. These include socio-political rationales that stress the public nature of highways and the need to have them "freely" accessible to all, that many of the benefits accrue in the form of greater national unity, national defence, generalized stimuli to regional and national growth and other such quasi-public goods. Hence no specific user-charges should be made since the benefits are widely diffused. However, highway investment, use and maintenance utilize resources that could have been employed to produce other goods and services of equal or greater value. To prevent over-investment and excessive use of highways, or anything else for that matter, requires the imposition of efficiency criteria. When competing wants are considered, so long as we live in a world of relative scarcity, resources and their use must be priced appropriately if they are to be provided in the relative quantities demanded at the least social cost. Thus highways produced in amounts decreed by non-economic criteria and financed from general taxation are likely to absorb excessive amounts of real resources. Some linkage between infrastructure production, financing and user as well as non-user costs and benefits is clearly required.

Another reason why these linkages have not been instituted in Canada and why there is no formal relationship between road taxes and expenditures is because data have only recently become available in Canada.[148] More important is that there is no general agreement on which of the various methodologies should be used to allocate highway costs even if all the appropriate data were available.[149] Considerations of efficiency easily become intermingled with equity, subjective judgement, costs occasioned versus benefits received, appropriate units of measurement and so on.

In short, there remain many controversial issues in this area before, as Nix puts it, any "cost-allocation study could be undertaken for policy guidelines."[150] This is not a counsel of despair, for various measures can be implemented that move in the direction of greater efficiency. The potential gains from so doing are substantial. The current financial administration of highway systems in Canada and the U.S. so disguises the real resource costs attributable to different users and non-users that efficient production and use of highways and substitute modes are seriously distorted. Since highways represent a significant portion of each nation's capital stock, and annual investments and users thereof represent a substantial share of national income and expenditures, it follows that there is probably considerable economic waste from inadequate user-charges.

## ESTABLISHING LINKAGES

Linkages between highway expenditure and road user-taxes or charges must be made. A more efficient set of user-charges for highway systems and an accompanying scheme of fuel and other taxes and fees must be designed to recover the marginal social costs of highway use from each user or user classification.

To begin with it is necessary to define a road user-charge with some care. Sales taxes on vehicles, trailers, parts and other transport equipment and income taxes on commercial providers of transportation cannot be construed as highway user-charges because they are unrelated to use of the highway. Even fuel taxes cannot logically be viewed as charges for the use of the highways *unless* they are established differentially higher than any existing general sales taxes and the additional proceeds specifically linked to highway costs occasioned by the users.

For existing highways, the costs to be recovered from users are the annual maintenance, repairs, superintendence, policing and administration cost that vary with highway use. Past capital costs need not be recovered — they are sunk costs. New highway investments should be made on the basis of well-known benefit-cost criteria.

(a) *Highway user-charges:* Even without complete information, user-charges can be established that will allow users to calculate the costs of additional vehicle trips that will specifically include the additional wear and tear, etc. on the highway itself. If congestion or pollution occur on certain highway segments, a differentially higher congestion or pollution levy can be added to the fuel tax for those using the affected segment. This is difficult to administer in practice but if the area affected is sufficiently broad it can be implemented well enough to have a positive impact upon highway congestion and that portion of overall pollution caused by vehicular traffic.

In other words, a properly designed fuel tax supported by licence and registration fees for vehicles, trailers and other highway user types, can come tolerably close to what is meant by marginal social cost. Indeed, this tax itself is a kind of synthesized price for highway services. It is not of course easy to determine the economically correct level of taxation nor the correct value of marginal cost for *each segment* of the overall highway system. There are many conceptual, empirical and analytical problems involved as indicated earlier. But acceptance of the principle of linking specific taxes to variable highway costs will itself provide incentives to improve and sustain such a linkage.

(b) *Toll roads:* Various highway segments may be constructed, improved or simply designated as public or private toll roads administered by some authority. The function of the authority would be to recover the full costs of the system. Under either private or public ownership, the authority could be mandated to establish a set of prices which, with projected traffic of various kinds, would permit the enterprise to cover costs, including a "normal" rate of return, with receipts. This could take the form of Ramsey or constrained market pricing based on the inverse of the elasticity of demand for the several services or products that minimizes the loss of consumer surplus while providing normal profits and efficient production.[151] This is especially important in situations where variable or marginal costs are declining, where large amounts of costs do not vary much with traffic volume or output and/or where economies of scale exist. In other words, if properly done, this represents an "optimal departure from marginal cost pricing" that avoids both subsidy and internal subsidization and permits strictly private operation and/or ownership. In this way, various highway segments could be more efficiently priced, and expanded or contracted, as cost and demand conditions warranted. At least, obviously "unprofitable" links in the system could be allowed to deteriorate rather than require ever more public resources to maintain even when traffic did not warrant.

Such authorities could of course exist only for selected corridors. The learning experience of attempting to link highway investment, finance and pricing together on a market-oriented basis, might well prove worthwhile. More and more activities hitherto viewed as having to be publicly owned and operated have now become privatized, in many cases with dramatic improvements in both efficiency and service quality. Such may be the case here.

(c) *Highway trust funds:* The linkage between costs and outlays is formalized under a highway trust fund analogous to that in the United States. Federal taxes on fuel, parts and so on are allocated directly to the Highway Trust

Fund (established in 1956) and used for construction of federal aid highways although there is no pretense that all of the taxes are strictly user-charges as defined above.

Before 1956, highway expenditures in the U.S. had been part of general revenues into which receipts from highway user taxes had been placed, as is the case in Canada now. The trust fund arrangement allows federal aid to highways to be more carefully planned over a longer time. Since future proceeds from the designated highway taxes can be forecast with reasonable accuracy, highway programs are more definite and no longer have to engage in an annual competition with all other federal programs. Outlays for highway maintenance can be regularized and not interrupted from time to time because of budgetary considerations.

The linkage involved is more consistent with efficiency criteria as noted above and also with the principle that highway users and beneficiaries should pay for the costs they occasion. In addition, if higher user-charges are needed, they are likely to be more acceptable if the users know they will be spent on highways rather than on something else.

On the other hand, extension of the trust fund concept would seriously limit the discretion that the federal government has over its expenditure patterns and could impede effective fiscal policy or important reallocations of government outlays. The current fuss about holding excess revenues in the trust fund for airports and airways in the U.S. for reasons related to the overall budget deficit rather than responding to the needs of overcrowded skies is an example of one kind of problem. Although widely heralded when initiated and with a reasonably good performance, the Highway Trust Fund must also be viewed in the larger framework of overall fiscal policy where its virtues are less obvious.

## 7. LESSONS FROM THE PAST: RELEVANCE TO CANADA

It might appear that there are only negative messages here for any other country, explaining only how to avoid some of the more egregious mistakes. Even if there were some positive aspects, it is unclear whether another country would profit much from them. Wilson's "second law" is that "no country learns from the mistakes of another." That is however rather defeatist and contrary to the purpose of this entire undertaking. Besides, even if the lessons are negative that does not make their message useless. Nor, given the proximity of Canada and the U.S. in ways well beyond geographical including the new forms brought about by the Free Trade Agreement, is it beyond the realm of possibility that some of the positive aspects of U.S. passenger transportation policies would be of some interest and even guidance to Canada.

Let us begin, however, with a certain paradox. Canada altered its transportation policy formally long before the U.S. and in a direction that the U.S. eventually copied. From erstwhile teacher to reluctant student and follower needs some explanation.[152]

## WHY CANADA WAS FIRST

The MacPherson Report of 1961 led to new legislation by 1967. Although some minor skirmishes occurred earlier in the U.S., as noted in Sections 4 and 5, it was not until the early 1960s that the first official reports began to emerge suggesting certain reforms but compromising on the need for regulation. There was President Kennedy's message but it went nowhere. The big lag in the U.S. was legislative — about 13 years, depending upon which modal reform measure used, compared with only six years in Canada.

There are several reasons for Canada's earlier success. The MacPherson Report was the result of investigations by a Royal Commission which gave it far more stature in Canada than any of the reports reviewed in this study have in the U.S. Congressional studies, presidential study groups, advisory commissions or task forces inevitably smack of partisanship and tend either to be very controversial or lacklustre — a kind of mixed bag to accommodate all the conflicting interests. As such they are far from being the kind of persuasive document that the MacPherson Report was, which focused strictly on the national interest. It not only emerged from a Royal Commission, which put it one step ahead of any of the U.S. transport studies in terms of prestige, but it was extremely well done and consistently argued. In short, it was persuasive in a sense that the U.S. reports were not.

The U.S. legislative process, even when a majority of legislators may be fully convinced of the desirability for some action, is inevitably more protracted for several reasons. During much of the period under review, the President was from a party different from either the Senate or the House majorities or sometimes both. This leads to far more bickering, politicking and belated compromising than would otherwise be the case.

Transportation in the 1960s was more significant to the Canadian economy and polity than in the U.S. If it could be demonstrated that the system was operating under great handicaps by virtue of "obsolete" regulation and that greater reliance upon market forces would lead to large efficiency gains, the prospects of early legislative success would be enhanced. On the other hand, the more important the issues the longer the debates would be and conversely for relatively unimportant issues. This did not occur in the U.S., however, because transportation, while important, kept getting pushed down the legislative priority list. The greater involvement of the U.S. in world affairs, for example, lead to a siphoning-off of Congressional and presidential concern. A trade-off between domestic and foreign concerns tended to predominate from the mid-1960s on including the Indochina War, the cold war, detente, and the more recent dramatic events in Eastern Europe and the ex-Soviet Union. Thus, not only was the case for deregulation not convincingly or forcefully presented as it was in Canada, it did not appear to require such urgent and immediate attention as other matters.

In addition, the U.S. regulation of transport, especially the trucking industry, was far more cumbersome, detailed and intrusive than that in Canada. It made the law and its interpretation more complex and, most importantly, it created a set of vested interests not only at odds amongst themselves but which resisted any change that affected them adversely or benefitted their rivals even relatively. The interest groups had powerful lobbies such as the Association of American Railways, the American Trucking Association, American Waterways Association, various shipper groups and labour associations representing each mode or broader labour unions such as the Teamsters, Longshoremen, etc. Any radical change in policy was bound to be extremely contentious thereby inviting Congressional rejection of controversial measures or emasculation of important aspects of particular bills. Even when legislation proposing somewhat greater reliance on market forces passed, it was frequently interpreted, by the ICC in particular, in such a way as to signal no change at all.

Finally, the process was prolonged by what some view as a greater propensity of U.S. business, labour organizations and private citizens to litigate and protest actions viewed as contrary to their interests than in most other countries, Canada included. Since the issues were often complex and hypothetical[153] there was much scope for litigation. Indeed, frequently, the Department of Justice would oppose ICC rulings as did, later, the Department of Transportation. The government itself did not speak with a single voice on transportation issues.

These appear to be the most plausible reasons for the long U.S. delay. There may have concurrently been aspects of the Canadian polity between 1961 and 1967 that made reform legislation more expeditious than would otherwise have been expected. I leave this part of the story to others more informed.

## CANADIAN-U.S. POLICY DIFFERENCES

There are, however, some aspects of both U.S. and Canadian transportation policies in general and passenger transport in particular that might usefully be raised at this point. The MacPherson Report relied upon intermodal competition in advocating regulatory reform and reliance upon market forces and said very little about intra-modal competition except where trucking was involved. Indeed, it relied upon the high degree of competition likely to prevail within trucking. It also relied on the possibility that own-account trucking and passenger car travel on increasingly ubiquitous, publicly provided highways would protect shippers and passengers from rail and air duopolies or tight oligopolies under deregulation.

The U.S., on the other hand, having sharply restricted competition within modes from 1887 through the 1930s, left intermodel competition to take care of itself. There were far more firms of each mode serving most city-pairs than existed in Canada. With freedom of entry there would have been even more firms competing — certainly enough to create workable competition and contestability. Yet progress in deregulating intra-modally was much slower than in Canada.

Nevertheless a paradox remains. While Canada relied largely, through necessity occasioned by relatively smaller markets and using the same transport technologies as the U.S., upon intermodal competition, there was never a policy of modal separation. On the other hand, the U.S., while restricting intra-modal competition up to the late 1970s, had a relatively strict policy against formal intermodal integration. In other words, the U.S.

was bent upon preserving the perceived specialized "inherent advantages" of each mode and competitive equality among them. From the vantage point of the 1930s and despite a much stronger antitrust tradition in the U.S., this seemed to require careful economic regulation and/or promotion of each mode including trucking and air transportation and greater reliance upon regulatory commissions than competition in transportation. Competitive forces intra-modally were to be constrained while those intermodally were to be encouraged — hence the twin policies of detailed intra-modal regulation and intermodal separation.

Canada's prospects for intra-modal competition in rail and air were naturally more limited and the regulatory philosophy inherited from the U.K. less militantly antitrust. Canada viewed industry structure as a poor indicator of competitiveness in that a high degree of concentration probably reflected scale or at least financial economies and was thus to be tolerated but carefully watched and/or regulated to prevent abuses. With this viewpoint, Canada not only adopted a transport policy based on intermodal competition but permitted the railways to enter any other mode they chose and to any extent. The results in practice for Canada were not much different from those in the U.S. because the railways did little to integrate, say, truck transport into their operations but treated truck subsidiaries as separate and largely independent and autonomous profit centres rather than as instruments to stifle non-owned truck competition. Various public investigations of rail ownership of trucking companies since the 1967 Act have found that:

> Nothing in this investigation, either the hearing phase of it or the information elicited by the extensive investigative work that we have done, reveals undue restriction of competition or prejudice otherwise to the public interest. . . . There has been this build-up of a trucking arm in CN and, as we have reported in this decision, Canadian Pacific is even larger in the trucking field than Canadian National. But these developments have proceeded alongside another development — the tremendous growth of that part of the Canadian trucking industry that is neither owned nor controlled by the railways.
>
> The growth of the trucking industry and the fact that it is now No. 1 among all the Canadian domiciled carriers of freight in terms of domestic operating revenues generated — this and the moderate size of the foothold which the railways have achieved in "for-hire"

> trucking — fatally flaws the contention that because the acquirer of Chalut is Canadian National Railways there is undue restriction of competition and prejudice otherwise to the public interest. That contention, certainly at this juncture in the development of Canadian transportation, is not well founded. Indeed, the investigation which we have conducted has exposed the other side of the coin: that the Canadian trucking industry at this time, and notwithstanding difficult problems that undoubtedly confront it, is continuing to forge ahead. The trucking industry is becoming of ever greater importance to the performance of the total transportation function in Canada.
>
> A meaningful foothold has been gained by the railways in the trucking industry but ownership and control of their segment of the industry does not as yet approach a condition of restriction of competition, let alone "undue" restriction of competition.[154]

Thus Canadian experience with permissive rail ownership of trucks and other modes has belied the fears that led the U.S. to stress modal separation. Not only has it had positive efficiency benefits in Canada but as Heaver concludes:[155]

> The railways have been able to participate in the growth of the trucking industry and have been able to perform their less than carload (LCL) common carrier obligations more efficiently than would otherwise have been the case. The existence of trucking subsidiaries allowed the rail operations to drop LCL services. Both the CN and CP hope that further integration of their express services with their trucking operations will lead to more efficient and profitable services.
>
> The railway-owned trucking companies have provided leadership in Canada in efficient management practices, for example, in their concern for costing procedures. These advantages have become less evident as a number of large trucking companies with sophisticated and innovative management have developed. However, since a number of the large firms are foreign-owned, the development of the large Canadian and railway owned trucking companies may be perceived in Canada as providing the benefit of significant national ownership in an important industry.

> These benefits have been realized while there is no evidence that railway ownership of trucking is having any adverse effects on the nation's transportation system. It is not leading toward the development of monopoly powers, nor is it likely to do so. It has not been associated at any time with the railroads discriminating in favour of their affiliated companies. There is no evidence that the availability of nationwide trucking and rail services is providing the railway owned companies with an advantage in negotiating with large shippers.
>
> In sum, the Canadian experience with the railway ownership of trucking has been positive and is likely to continue to be so. Railway ownership of trucking is not now a significant issue in Canada.

This is another instance where Canadian policy has influenced that of the U.S. in transportation matters.

On the other hand, the Canadian concern for intra-modal competition was heightened by the airline deregulation in the U.S. in 1978, the rail and truck deregulation Acts of 1980 and their apparent benefits — some of which spilled over into Canada. In fact, these U.S. intra-modal initiatives were quickly followed in Canada by a new transportation framework entitled "Freedom to Move" dated July 1985 which formed the basis for the new *National Transportation Act* (NTA) in 1987 which, among other things, asserts that important economic objectives are likely to be achieved "when all carriers are able to compete, *both within and among the various modes of transportation* [emphasis added]" — a sharp change from the previous stress on intermodal competition. Other aspects of the NTA follow similar features embodied in the U.S. legislation.[156]

In this sense, Canada was the first nation to embody "greater reliance upon competitive forces" into legislation in 1967 but the U.S. was first to deregulate intra-modal transportation.

It is now evident that, as far as the general policy of more reliance on market forces is concerned, both inter- and intra-modal competition is required. If competition is capable of being most effective where the firms involved have quite similar products and cost structures, as competition theory indicates, then it was folly from the outset in the U.S. to have attempted to thwart this, especially in air, truck and bus transport. Intermodal competition where firms produce products of quite dissimilar characteristics and have vastly different cost structures, is apt to have specialized advantages for particular kinds of travel or traffic allowing spheres of modal monopoly power, without intra-modal competition therein. These were the so-called "inherent advantages" that the U.S. sought to preserve by its abridgment of the most effective competition, namely intra-modal. There was also much concern that the newer forms of transportation — air, truck and bus — in the 1920s and 1930s would need protection from rail predatory behaviour to develop their natural niches in the total transportation market. There was also concern that the regulated railways, suffering financially during the depression, needed some protection against the new modes not then subject to regulation and control. In this way "competitive equality" was joined with "preservation of inherent advantages" of each mode as rationales for the twin aspects of policy namely, modal separation and intra-modal regulation.

The problem with both of these was that they were based upon static views of both technology and inherent advantages. As the economy grew and changed, the relative importance of the quality elements became far more important than relative marginal cost differences among the modes for both travellers and shippers (higher values of time, comfort and convenience for passengers and just-in-time deliveries for shippers, for example). New technologies responded to these changes and also reduced the need for separate modal ownership and operations (for example, TOFC, COFC, RO-RO [Roll on-Roll off] etc.) as complementarities among the modes began to grow in importance, eroding the "inherent" differences which turned out to be less than immutable.

At the same time, the fear of rail predation against the other modes turned out to be vastly exaggerated. In all these experiences and trials, both countries learned from each other. Both intra- and inter-modal competition need to be free for maximum potential benefits.

Other differences between the U.S. and Canadian approaches to national transport policy may provide certain lessons for each country. On a very general level and subject to many caveats, Canadian policy is more centrist, deliberate and proactive whereas the U.S. is less centrist, more pragmatic and reactive.

In Canada, the federal government was closely bound up with railways from the start. In fact, construction of the railways was part of the deal for Confederation. In the U.S. the private sector was first involved, and the states and municipalities bribed, cajoled and otherwise sought to control rail development as much as possible through their territories. The U.S. federal government only later was involved in helping finance rail development.

In the U.S., central government acts mainly after it becomes clear that states or cities want it to on particular issues and/or when states cannot effectively act individually. Thus the *Act to Regulate Commerce, 1887* came after some states had already instituted railway regulation and were subsequently enjoined by the courts from regulating interstate commerce which was growing very rapidly. In Canada there was no doubt from the outset that rail regulation was a federal affair. Similarly in trucking, the U.S. regulated because the bulk of the business by the mid-1930s was interstate and the federal government had reluctantly became deeply involved in highway finance prior to the first highway Act in 1916. The Canadian federal government deliberately stayed out of interprovincial trucking regulation even though it was authorized to do it (Part 3 of the NTA of 1967) and left that authority to the provinces partly because of awareness of the messiness that similar regulation had caused in the U.S.

Of course, in both countries the role of the central government increased relatively since the early 1930s in transportation and elsewhere. In general, this creates national standards in such key areas as transport and health, and thus, there will be a tendency toward state, provincial and regional equality. This may not be very efficient however. For example, the U.S. interstate highway system was built to the same standards throughout the country regardless of actual or potential traffic. Nevertheless such national standards ensure that the poorest states and provinces will not fall progressively behind the more affluent in important aspects.

Both countries are now yielding to more state and provincial autonomy in part due to relative failures of economic policy at the federal levels, ideological trends to "conservatism," states-rights and the like, but largely due to huge federal deficits. If not pushed too far, this provides the opportunity for a variety of experimentation with policies in transportation and elsewhere that may yield valuable lessons more significant than forcing all into the mold of homogeneous national standards. To paraphrase President Kennedy, it may be beneficial to keep the nation safe for diversity.

In the final analysis, the greater apparent centrism and deliberateness in Canada with respect to transportation policy may not make much difference because the relative average size of each province to the total nation is many times larger in Canada than the U.S. (e.g. 10 provinces compared with 50 states). Thus, regardless of the degree of apparent centralization of power, the actual importance of the individual provinces in Canada on average is much greater than the individual state in the U.S.

## LESSONS FROM THE U.S. EXPERIENCE

One is impressed that over longish periods of time the U.S. government has responded reasonably well to the dynamics of population growth and movement, technological changes and other shifts in the economy that have sometimes belatedly, sometimes prematurely been recognized. To be sure, few of the investments or subsidies have been thought of strictly or even casually in economic terms, but none of them have been totally unwarranted. Too much rail investment was probably stimulated by the land grants in the 19th century. Highways and airways have generally had excess capacity since the late 1920s. These may suffer from selected bottlenecks at present, due to increased use arising from inadequate user-charges and generalized economic and population growth. However, except for some more or less substantial rail disinvestment, abandonment of some early canals, building the interstate system with the same capacity throughout the country regardless of potential traffic in specific regions, and some airway and airport capacity problems, capital or public expenditures have not been wasted in transportation, despite the emphases upon defence, national cohesion and nation-building earlier. In some more recent cases, public reticence to expand capacity is more of a problem than capital extravagance.

It is in the realm of regulation that obviously uneconomic decision making has taken place in the U.S. transportation sector. Economic regulation of a particular industry by a separate, independent commission is something not to embark upon lightly. Even if the objective is to restrict excess profits and remove discrimination, and otherwise reduce the static welfare loss which itself is not the major waste involved, far more is required than rate of return and/or price regulation. The regulatory body must be prepared to control entry and exit, to monitor a structure of prices, to ascertain a reasonable proxy for marginal cost of specific services, to control service offerings and qualities, to monitor finances, to have some say in new investments and acquisitions and, in fact, to become informed of and involved in virtually all aspects of the companies being regulated. It is not possible to select one or two variables and gear policy to these alone, expecting to make the performance of the industry more efficient without substantial costs to society both direct and indirect. Nor is it possible to stimulate what may be crucially important, namely the "entrepreneurial spirit." The "dead hand" of bureaucracy, political gamesmanship and the like are apt to divert attention from economic matters. Even single-firm monopoly cannot be regulated in terms of allowable rates of return without unwanted side effects such as inefficient production, expense padding and other aspects of the so-called A-J-W effect.[157] How much more complex it is to seek to regulate dozens or even hundreds and thousands of firms, as the ICC did following the *Motor Carrier Act of 1935*, with their varying cost and service characteristics, different capital intensities and other special features. The attempt to regulate such a hodge-podge is bound to fail if the objective is efficiency or the achievement of non-economic goals at least cost and the maintenance of some spirit of enterprise and risk-taking.

The experiment with industry-specific economic regulation has failed in the U.S. The message worth conveying to other countries is not to embark upon such a venture except in the context of safety. If the country is already regulating, it should begin the reform process with emphasis upon efficiency. Certainly it should not regulate to protect government-owned and operated railways. Canada does not need this lesson since federal regulation was never invoked for motor carriers. Provincial regulation, however, is not much better and should be reduced to at most a standard of "fit, willing and able" to new applicants offering a particular service.

In cases where, for political or less often, economic reasons, there is some propensity to regulate or regulations already exist, antitrust criteria should be applied. This, in turn suggests that "regulation" might best be left with the antitrust authorities, even in situations of true natural monopoly. Where antitrust or anti-combines laws are weakly enforced, as is the case in Canada, they should be strengthened and applied more frequently in such a manner that the business community becomes acutely aware of the consequences of violating the competitive standards. The consequences need to bear higher penalties than apply at present in Canada although the competitive implications of the Free Trade Agreement should be positive. If the antitrust laws are so weak or weakly enforced that they have little deterrent effect upon anti-competitive business practices, it may be necessary for a specific industry to be directly constrained by a separate commission or board. If so, efficiency in the market sense should be the overwhelming criterion. The legislation should be precise, should give the board little discretion or opportunity to develop a "grand design," and its powers subject to a sunset rule after a decent interval in which an assessment of the performance of the industry is made and side effects evaluated.

Aside from the very few instances where the government owns and operates a productive enterprise which cannot be largely privatized, the rule should be that of a market economy. It should be monitored by strict antitrust laws vigorously enforced and should include a set of charges for use of publicly provided right-of-way and carefully applied effluent and congestion taxes so that social and private costs can be made to coincide as closely as possible. Under these conditions, competitive market forces will tend to bring about efficient outcomes, be responsive to consumer demands and flexibly adjust to changes in technologies, input prices, incomes, tastes and preferences. There will still be plenty for the government to do, but the microeconomy should be able to provide for the demands of the populace with a minimum of overt intervention but with continuous vigilance. The government can then devote more time to performing better on the macroeconomic level and concentrate on doing those things more appropriate to its capabilities.

## THE MESSAGE FOR PASSENGER TRANSPORTATION

Canada led the U.S. in the general policy change area in transportation and indeed set a good example to follow. However, the U.S. led in a perverse direction with respect to rail intercity passenger transportation in creating Amtrak in 1971. Just six years later, and following the miserable example of the first five years of Amtrak's existence, Canada copied the U.S. "solution" to the rail passenger deficit problem. The results were pretty much predictable. Rail passenger service in both countries is largely uneconomic and its continued provision with subsidy jeopardizes the development of bus service in areas of low-density traffic and wherever both rail and bus competition exists. If some rail service is to be preserved, beyond the urban-suburban areas where it is essential for commuting purposes and where it is correctly viewed as part of the entire urban problem that goes far beyond mere transit, it will have to be confined within heavy-density corridors. In Canada this rules out any of the super high-speed alternatives with maximum speeds approximating 300 mph and most of the alternatives in the range much above 125 mph as well because of lack of traffic density and the huge capital costs of the required exclusive rights-of-way.

As Soberman has suggested, higher speeds can be obtained on the Montreal-Toronto corridor in the 112–125 mph range which might offer some prospects of economic feasibility. But this would have to be accompanied by "improved reliability, and twentieth century passenger handling, ticketing and reservation systems."[158] Some large investments in existing track, electrification along with tilt-train technology and improved communication systems would be necessary to achieve even this modest speed range. However, these investments might prove economically viable and the resultant three-hour service on the Montreal–Toronto run should be attractive. A similar situation exists in most of the U.S. corridors being considered although several of them may have sufficient density to warrant experimentation with the facilities designed for the higher speed ranges well above 125 mph, already achieved in regular service and higher still in experimental runs, over 300 mph.

The point to emphasize, however, is that maintaining rail intercity transportation options to provide access to remote areas or regions without any other public transportation alternatives is self defeating. Since the rail service is subsidized, this inhibits development of at least some unsubsidized bus alternative. It is not the sort of operation suitable for rail in the first place; it is not part of railroads' "inherent advantage." Clearly, this is an inappropriate reason for Amtrak's or VIA's existence although it is often given as a rationale. Whatever future they may have cannot be confined to such inherently uneconomic service for it jeopardizes a better and cheaper alternative, namely, bus transport. Since neither Amtrak nor VIA can become the nationwide systems they once were, high-density corridor business is all that remains where subsidy could be minimized if not eliminated. Even here, the prospects are bleak unless much more is invested in providing higher speeds.

The U.S. now requires the ICC to investigate bus owner complaints of predatory pricing by the subsidized Amtrak and to take steps to prevent it. That seems to be the least that should be done so as not to discourage more competitive development of the bus alternatives in various regions and for the specific clientele that has always typified bus travel. If subsidy is to be given, its benefits would doubtless be larger, per dollar of subsidy, if provided for bus operations that were deemed necessary or desirable, if not efficient, to serve otherwise isolated regions or to provide at least some access for those unable to drive or afford their own vehicle.

"Some elements of the system clearly must disappear," Soberman concludes with respect to VIA Rail.[159] This applies to Amtrak too. It is merely a question of choosing which parts to eliminate, if not the entire operation, in the interests of a viable and competitive intercity *national* passenger system. The Doyle Report had it right even before Amtrak.

## SOURCES OF COMPETITION IN INTERCITY PASSENGER SERVICE

If VIA or Amtrak are confined to corridor service, where abundant competitive forces both among and within modes already exist, what will ensure competition in the other segments of intercity passenger traffic? The private automobile provides much of the answer because of the ubiquity of the highway system. If rail service disappears from all but a few corridors, this leaves only bus and air service elsewhere. However, bus and air are scarcely competitive in the same markets. There is some complementarity but not much overlap. Bus transport will dominate over short distances and air over long. Each caters to a different clientele. Thus competitive forces in the lower-density intercity markets will rely primarily upon intra-modal rivalry. Some intermodal competition between air and bus may occur with the use of commuter-type planes or, perhaps later, tiltrotor aircraft. Further development of "intelligent vehicle-highway systems," linking "smart cars" with "smart highways" may significantly improve bus performance characteristics as well, (e.g. "smart" buses). This is highly speculative. But the future possibilities do hold out some prospects for enhanced competitiveness between these two modes for distances below say, 200 to 300 miles. Clientele may overlap depending upon relative costs. In the meantime, intra-modal competition will have to suffice.

Technically speaking, both modes have most of the features required for effective or workable competition. This was indeed the entire basis for deregulating the airlines in the first place. The same is true for the bus industry despite its penchant for high levels of aggregate concentration even when federal regulation was not overly restrictive because of benign neglect. It is because of the need to rely on intra-modal competition in each, that the recent tendencies toward monopoly power in air and the perpetuation of concentration in the bus industry should be viewed with more concern. The problem in bus transport lies mostly with state or provincial regulation. Efforts to reform these constraints should be encouraged by the federal governments in both countries. The situation is more serious in air and will require strong remedial efforts already noted in Section 6. However there is nothing to suggest the need to return to the past cartel-type of arrangement in either industry. Nor are the prospects for more competitive behaviour unpromising. The view that competition is obviously workable in each industry should elicit appropriate responses to ensure that it is made to do so.

The "open-skies" movement and the Free Trade Agreement also provide prospects for increased competitiveness. Policy now needs to refocus explicitly upon the passenger side of the transportation market and concentrate again on air and, perhaps for the first time in any major sense, upon the bus industry. This Royal Commission itself is evidence of the new concern for passengers vis-à-vis freight and it is hoped that the emphasis will continue upon efficiency criteria à la MacPherson.

The regulatory reform process is not over.

There is a problem with respect to very low-density travel involving small communities which would not generate enough traffic on a regular basis to warrant either scheduled service or more than one carrier even with small, say 10 to 12 passenger buses, or commuter aircraft. The preferred solution will vary from case to case but efficiency cannot rely on competition among carriers eager to enter the market or actually offering service. Rather, service will need to be provided by non-profit organizations or contracted for through competitive bidding and financed with at least some public funds. In northern, remote regions of Canada where some rail services exist they may validly be continued even at a loss but the costs could probably be reduced "by eliminating VIA Rail as the middleman and having Transport Canada contract directly with the relevant railways."[160] Several alternatives are available that could sharply reduce costs even though overall profitability is unlikely.[161]

## THE ISSUE OF SUBSIDY

General subsidies for multi-product enterprises serving diverse markets normally lead to inefficient pricing, especially in the contestable submarkets where below marginal cost prices create unfair competition for the non-subsidized competitors. But passenger transportation services to remote, peripheral or sparsely populated and/or poor communities may not be profitable nor financially sustainable, except through subsidy. In such cases (and where the political authorities decide *some* level of service is needed in the public or social interest), an operating subsidy that makes up the difference between the revenues derivable from a specified service level and the avoidable costs under honest and efficient management would be warranted. Such subsidy will also be efficient as long as it is route-specific and the avoidable costs of the subsidized service are lower than any other mode or operator could achieve for comparable service levels. Contracting for such services is desirable along with close monitoring of the results.

Various subsidized route-specific services exist in Canada and the U.S., including in Saskatchewan, Pennsylvania and Maine, where experience has shown that close examination is necessary before specifying any management program for establishing additional subsidized services.

There is nothing inherently wrong with subsidies provided the goal they seek cannot be achieved more efficiently by any other means, including reliance on market processes. Too often societies have sought to benefit some group, such as poor or disadvantaged people in outlying regions, by non-specific subsidies, or general cross subsidization by large enterprises in the transportation industry. The costs associated with these subsidies go far beyond the amount paid, as they cause serious price and cost distortions elsewhere in the system. Furthermore, the so-called benefits do not meet the primary needs of the groups for which they are intended. The benefits of transport subsidy are essentially a system of partial income supplements tied to consumption of a specific good or service. These can be provided more efficiently to the recipients without causing distortions that could have wide ramifications within a particular industry. Income supplements, if made directly to recipients, preserve their freedom of choice. Cheaper transportation may have little impact on poverty levels or the quality of life of disadvantaged or poor people since the subsidy is confined to travel only which is often only a small subset of needs.

## OTHER MESSAGES AND LESSONS

I began this essay by noting that three major themes had dominated the evolution of transportation policy in the U.S.: (1) Inconsistency and ad hocery, (2) Dominance of freight transport over passenger, and (3) Changing role of economists.[162] The policy changes since the late 1970s are not only the latest episode in these themes but they may have altered them in important respects.

(1) *Inconsistency and ad hocery:* One of the major contributions of regulatory reform in transportation has been to raise the consciousness of the public to the superior organizing properties of competitive markets and the opportunity cost concept. This provided impetus for reform in other industries as well, including communications, banking, insurance, brokerage, power, gas and oil transmission, and others. Indeed, every area subject to some form of pricing and entry or exit constraints has been under increasing pressure to ease or eliminate them and to allow more discretionary and flexible decisions by individual companies. In short, regulatory policy virtually everywhere has adapted to competition by allowing more competitive-like behaviour and practices hitherto disallowed. Not all have been as successful as in transportation. One only needs to be reminded of the savings and loan debacle, although that was a case of botched deregulation. Most reforms have resulted in real savings to the consumer, greater efficiency and flexibility of firms to respond quickly to changing circumstances.

But the widespread understanding that efficient pricing and market orientation coalesce and that therefore much of the previous anti-competitive and anti-market regulations were not only superfluous but absolutely wasteful as well, means that one aspect of inconsistency and *ad hocery* in transportation policy in the past has been removed. Policy can no longer be completely open-ended as to purpose. Whatever the purpose, we now demand to know the cost and whether the purpose can best be achieved through anti-market manipulation of the transport industry or by some other less costly means. Even national defence is now expected to be cost effective! Whatever the purpose, stability, national cohesion, defence, etc., will not be pursued without an assessment of costs involved compared with alternative mechanisms.

Thus, for example, it is doubtful whether the *Act to Regulate Commerce* in 1887 could be enacted today. The evil sought to be remedied then was discrimination of various kinds. The first section of the Act declared that all rates be "just and reasonable" and the next three sections specified various kinds of discrimination that were unjust and unreasonable — essentially place, personal and long- and short-haul discrimination. The present approach to such a situation, assuming the antitrust laws would not suffice, would be to increase competitive pressure by facilitating new entry of firms producing similar services. Of course, any private actions to fix prices and artificially exclude entry would be declared illegal as they are now under existing antitrust statutes. In no way would the current approach provide a small group of commissioners with power to cartelize such a huge industry in its entirety. Whatever solution were adopted today would be consistent with market forces not counter to them. Clearly, no commission would be allowed to attempt any grand design as did the ICC or to organize the scheduled airlines into a more effective oligopoly as did the CAB.

For Canada it is likewise apparent that the Crow's Nest Pass rates legislation would not be enacted again, not only because its stated purpose had long since been accomplished but also because of the mechanisms for railway redress recommended in the MacPherson Report and especially because there now exist more direct, more effective and less costly ways of accomplishing similar objectives. The same goes for the *Maritime Freight Rates Act*. Certainly, subsidy to passenger transport would not be allowed to piggyback, so to speak, upon freight revenues as already apparent in the creation of VIA and the general philosophy and emphasis on efficiency and market orientation. There are simply more effective and less costly ways of accomplishing the objectives of these three policies than were followed for many decades in Canada. National policy will henceforth not require higher real costs of transportation as the major instrumentality.

Thus transportation policy including investment policy can be expected to be more consistent in the sense that economic analysis will be given higher priority than before and efficiency criteria, "market conformability" and cost effectiveness will dominate. That does not mean that mistakes will not be made. Even proficiently handled benefit-cost analysis is no more than a guide to public investment and there are plenty of ambiguities in determining marginal costs, appropriate user charges and the like. However, policy should be expected to be based at least on reasonable economic analyses and data and less warped by such notions as the "grand transport mystique," the special status of being a "public utility" or a "natural monopoly" because of some alleged economies of scale properties and so on. With the present transportation options facing both travellers and shippers, there is no reason to single out the area for treatment any different from other industries. Thus transport policy can avoid much of the ad hocery and inconsistency of the past. We can hope, for the sake of efficiency, it will do so.

(2) *Dominance of freight transportation:* The uniqueness of the passenger business, as distinguished from freight, has now been assured by the separation of rail passenger service from goods movement. This is not yet complete but will be whenever Amtrak obtains more of its own right-of-way or is confined to that which it already has. Aside from this, there is no major transportation enterprise handling both large numbers of passengers and large amounts of freight in the U.S. Assets are largely dedicated to one or the other and operations and ownership for the most part are separate. For the first time this permits the inherent differences between the two industries to receive exclusive attention by all modes in the U.S. Furthermore, future transportation technologies such as maglev, high-speed rail, "smart" cars, tiltrotor aircraft are all passenger-oriented. While some are adaptable to freight (e.g. "smart" trucks), most are unique to passenger travel in the sense that they emphasize smoothness and comfort of the ride, as well as speed, dependability and safety which are arguably more important for passengers than for most freight. Freight transport technologies are likewise moving in their own more distinctive directions so that the differences between the two can be expected to widen. This will, of course, mean that any future policies toward transportation must specify either passenger or freight and not casually assume that because problems arise in freight transport their resolution should *ipso facto* apply to passengers, as has been the case in the past. As noted earlier, the creation of this Royal Commission is evidence that passenger service is no longer considered an unavoidable but unwanted stepchild of freight operation.[163] It is an important industry in its own right and sufficiently different from freight that even in rail transport it can no longer be viewed as a by-product.

If VIA is to continue, it will have to be given its own trackage over important route segments or at least over all routes it is expected to operate in the long run. The more complete separation of both ownership and operation from freight is essential for a valid test of whether there is any viable future for rail intercity passenger traffic in Canada and where that might be. If VIA cannot do it with ownership and operation rights and substantial freedom to price and market efficiently, then it should be closed down and its services leased to the highest bidder for one more try. Part of the lesson of Amtrak implies substantial track ownership and control in the most important, heavy-density corridors and as complete a separation from freight operations as possible. Clearly any new higher speed passenger services will have dedicated and specialized track.

(3) *The changing role of economists:* Since the transportation industries, including both freight and passenger, are now pretty much viewed as not fundamentally different from other industries producing either goods or services, microeconomists of all stripes can continue to study them without feeling guilty about invading the terrain of "transportation economists," as if that connoted some special expertise or knowledge about some unique type of economic activity. In fact, as noted earlier, the period when the economic case for regulatory reform was being fully developed and later implemented, involved the return of more general economic theorists to the study of transport problems. With the legislative successes now under their belts, there is some danger that microeconomists might drift away from transportation as they did after the late 1920s.

I doubt whether this is likely. More and more economists have had a taste of the area and have become involved with engineers and computer specialists in modeling various aspects of, for example, traveller choice, optimal routing, to say nothing of monitoring the consequences of the regulatory changes that have already taken place, the new patterns of price discrimination including Ramsey pricing, hub dominance, the net benefits already achieved and so on. There is much to do theoretically, empirically and in terms of systems-type modeling that intrigues most of the new generation of mathematically sophisticated and computer-literate economists.[164] Thus I see little prospect of neglect of the field merely because issues of regulation have more or less been resolved and part of the battle for improvement has been won. As Schumpeter long ago remarked: "specialists in applied fields, mostly in . . . transportation, had got further" than others in understanding price discrimination. He cites Hadley's, *Railroad Transportation*, 1886 as being the first to show that rate discrimination "may improve the situation of all parties concerned, including the one that is discriminated against."[165]

The study of transportation has contributed much to economic theory. As Baumol and Bradford note, the "general line of argument (regarding optimal departures from marginal cost pricing) has appeared widely for the better part of a century. The formal theorems date back more than forty years — this work has appeared in some of our leading journals under the authorship of some of the luminaries of our profession and was clearly not limited to a backwater of the literature."[166]

But if the study of transportation has contributed much to economic analysis the reverse is also true. Again it is Schumpeter who points out that "Any decent theory of cost and price ought to be able to make valuable contributions to railroad economics, and railroad economics ought to be able to repay the service by offering to general theory interesting special patterns and problems. . . . There are great possibilities in a co-operation of economists and engineers . . . few fields offer such possibilities as obviously as does the railroad business."[167]

It is just this close mutuality of interests and cross fertilization that ensures that transport will remain an active field of research for professional economists. Benign neglect is unlikely to recur even with the diminished interest in regulation.

This is true in Canada and indeed in most other countries. Some of Canada's most prominent economists have devoted much time to transportation issues and continue to do so. The Canadian Transportation Research Forum, the Canadian Institute of Guided Ground Transport and many other groups of economists, engineers and computer scientists are actively engaged in transportation matters to say nothing of the many university institutes, majors and courses devoted to the subject. In this sense, Canada has nothing to learn from the U.S. If U.S. economists played a decisive role in the deregulation movement in the U.S., which demonstrably they did, it was mainly because such a highly visible role and attainment of high-level positions of administrative influence was necessary given the strength of the resistance to change compared with that in Canada. Both countries are thus well endowed with economists sufficiently concerned with transportation that the efficiency flag may be expected to keep flying for several decades at least or until some more grandiose paradigm displaces it.

## ENDNOTES

1. Thomas K. McGraw, *Prophets of Regulation* (Cambridge, Mass.: Harvard University Press, 1984), p. 305.

2. Special Message to the Congress on Transportation by President Kennedy, The White House, April 5, 1962.

3. National Transportation Policy Study Commission, *National Transportation Policies Through the Year 2000* (Washington, D.C.: Government Printing Office, 1979).

4. Ibid., p. 43.

5. For an elaboration, see George W. Wilson, *Economic Analysis of Intercity Freight Transportation* (Bloomington, Indiana: Indiana University Press, 1980), pp. 274–81.

6. *Royal Commission on Transportation* (The MacPherson Report) (Ottawa: Queen's Printer, 1961).

7. Ibid., Vol. 1, p. 17.

8. Ibid., p. 43ff.

9. For example, the ICC might hold rail rates well above those of barge lines to preserve the latter in case of military necessity. Such "protection" of a higher cost mode was called "umbrella rate making" and was one of the major problems tackled by *The Transportation Act of 1958*, discussed in section 4.

10. George W. Wilson, *Economic Analysis of Intercity Freight Transportation*, p. 280.

11. U.S. Department of Commerce, Office of the Federal Coordinator of Transportation, *Passenger Traffic Report* (Washington, D.C.: Government Printing Office, 1936).

12. M. Farris and H. Harding, *Passenger Transportation* (Englewood Cliffs, N.J.: Prentice-Hall, 1976), p. 241.

13. George W. Wilson, "The Relative Importance of Economic Regulation of Transportation *vis-à-vis* Everything Else," in *Economic Regulation: Essays in Honor of James R. Nelson*, edited by Kenneth D. Boyer and Willaim G. Shepard (East Lansing, Michigan: Michigan State University, Division of Research, 1981), pp. 24–25.

14. George W. Wilson, *Essays on Some Unsettled Questions in The Economics of Transportation* (Bloomington, Indiana: Foundation for Economic and Business Studies, Indiana University, 1962).

15. See George W. Wilson, "Economic Analysis of Transportation: A Twenty-Five Year Survey," *Transportation Journal*, Fall 1986.

16. Some have even gone so far as to translate passenger-miles into ton-miles by converting passenger weight, including baggage, into tonnage to obtain a presumed homogeneous unit of "stuff" to be moved various distances.

17. See the last issue of *Transportation Facts and Trends*, Transportation Association of America, December 1974.

18. Mark Hansen, "U.S. Intercity Passenger Transportation Policy: 1806–1990," in *Canadian Transportation Policy*, edited by David W. Gillen (Kingston, Ontario: John Deutsch Institute for the Study of Economic Policy, Queen's University, April 1990), p. 22.

19. Some states have bumper stickers that read, "Welcome to X. Please go home!"

20. See F. W. Taussig, "Railway Rates and Joint Costs Once More," *Quarterly Journal of Economics*, February 1913; F. W. Taussig and A. C. Pigou, *Railway Rates and Joint Costs*, ibid., May 1913.

21. Cited in George W. Wilson, "Economic Analysis of Transportation: A Twenty-Five Year Survey," p. 35.

22. Alfred E. Kahn, Civil Aeronautics Board, 1974.

23. The pricing freedom was only partial in that it applied to traffic where the railways involved did not have "market dominance" and where they were deemed not to be "revenue adequate" overall. Needless to say the ICC attempted to construe these terms so narrowly that the rate freedom provisions of the *Staggers Rail Act* would have been largely nullified. In this, the Commission failed. In fact, it soon relented as new Commissioners were appointed or former Commissioners not replaced, leaving a majority in favour of the deregulatory initiatives made all the more pressing under President Reagan's broadside attacks on regulatory restraints of virtually any kind.

24. J. M. Munro and G. W. Wilson, *Road Transport: History and Economics*, Indiana Readings in Business, No. 35, (Bloomington, Indiana: Bureau of Business Research, School of Business, Indiana University, 1962), p. 55.

25. *Federal Aid Road Act, 1916.*

26. Mark Hansen, "U.S. Intercity Passenger Transportation," p. 27.

27. J. M. Keynes, *The Economic Consequences of the Peace* (New York: Harcourt, Brace and Howe, 1920), p. 9.

28. Thomas K. McGraw, *Prophets*, pp. 4–5.

29. See A. M. Milne and A. Laing, *The Obligation to Carry* (London: Institute of Transport, 1956), which is the classic study on the issue. For recent applications of the common carrier obligation see P.M. Shannon, Jr., "The Common Carrier Obligation in an Unregulated Environment," *Transportation Research Forum Proceedings*, 1980, pp. 476 ff.

30. I. L. Sharfman, *The Interstate Commerce Commission* (New York: The Commonwealth Fund, 1931), Vol. 3, p. 617–27.

31. Donald M. Itzkoff, *Off the Track, The Decline of the Intercity Passenger Train in the United States* (Westport, Connecticut: Greenwood Press, 1985), p. 30.

32. D. R. Owram, "Icons and Albatrosses: Passenger Transportation as Policy and Symbol in Canada," in Volume 3 of this report.

33. Pennsylvania Truck Lines, Inc.–Control-Barker, 1 M.C.C. 101, 1936.

34. 79 Congressional Records 12206, 1935.

35. H. G. Moulton, "Fundamentals of National Transportation Policy," *American Economic Review*, December 1933, pp. 33–46 and *The American Transportation Problem* (Washington, D.C.: The Brookings Institution, 1933).

36. United States Senate, Special Study Group on Transportation Policies in the United States, *The Doyle Report: National Transportation Policy* (Washington, D.C.: Government Printing Office, 1961), pp. 221–22.

37. National Transportation Policy Study Commission, *National Transportation Policies Through the Year 2000*, p. 255.

38. *Royal Commission on Transportation*, (The MacPherson Report), Vol. II, p. 82.

39. Ari Hoogenboom and Olive Hoogenboom, *A History of the I.C.C.: From Panacea to Palliative* (New York: W. W. Norton, 1976), p. 110.

40. U.S. Department of Commerce, *Passenger Traffic Report*, p. 16.

41. Ibid.

42. Ibid., p. 7.

43. Ibid., pp. 1, 7, 26–28.

44. Donald M. Itzkoff, *Off the Track*, p. 13.

45. This is vividly portrayed in D. Itzkoff, *Off the Track*, pp. 15–18.

46. Ibid., p. 18.

47. George W. Wilson, "The Effect of Rate Regulation on Resource Allocation in Transportation," *American Economic Review*, May 1964.

48. For an elaboration of both "stories" see G. W. Wilson, *Economic Analysis of Intercity Freight Transportation*, chapters 1, 2 and 3. Referring strictly to demand see G. W. Wilson, "Notes on the Elasticity of Demand for Freight Transportation," *Transportation Journal*, Spring 1978, and references cited therein.

49. Cited in Munro and Wilson, *Road Transport*, p. 67.

50. *Historical Statistics of the United States*, (Washington, D.C.: Government Printing Office, 1975), Vol. II, p. 769.

51. George W. Hilton, *Amtrak* (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1980), Table 1, pp. 3–4.

52. See Thorstein Veblen, *The Engineers and the Price System* (New York: The Viking Press, 1983), first published 1921.

53. Thomas K. McGraw, *Prophets*, p. 210.

54. See James M. Landis, *The Administrative Process* (New Haven: Yale University Press, 1938).

55. Hoogenboom, *A History of the I.C.C.*, p. 143.

56. The Hosmer Report, p. 72 (Reference No. 3, Table 1). See also George W. Hilton, "The Hosmer Report: A Decennial Evaluation," *I.C.C. Practitioners' Journal*, Vol. XXXV, No. 3, 1969, pp. 1472–73.

57. For a particularly illuminating comment on the efforts of the railroads at this time see D. Itzkoff, *Off the Track*, pp. 30–40.

58. George W. Hilton, *The Transportation Act of 1958* (Bloomington, Indiana: Indiana University Press, 1969), p. 13.

59. Hoogenboom, *A History of the I.C.C.*, p. 144.

60. Interstate Commerce Commission, *The Regulatory Issues of Today*, 1975, p. 2.

61. Cited in George W. Wilson, "Regulation, Public Policy, and Efficient Provision of Freight Transportation," *Transportation Journal*, Fall 1975, p. 8.

62. Interstate Commerce Commission, *First Annual Report of the Interstate Commerce Commission, 1887* (Washington, D.C., 1887), pp. 30–31.

63. Citations from Hoogenboom, *The History of the I.C.C.*, p. 150.

64. Jeremy Bentham (1748–1832) was the founder of utilitarianism in its more contemporary form. Briefly, this involves the attempt to measure the "pleasures" and "pains" or, in modern terms, the "benefits" and "costs" of any change in laws, regulations or specific decisions such as those made in every case before the ICC. The Benthamite notion was that one could somehow add up the benefits and costs of any action or decision and, if the former exceeded the latter, the decision was deemed good, desirable or a net improvement in welfare, and vice versa if the latter exceeded the former. Bentham hoped to be able to devise a metric, say units of utility and disutility, by which one might be able to aggregate and quantify the results of any decision — a kind of felicific calculus by which laws, decisions, etc., could be changed or reformed so as to contribute to the "greatest good of the greatest number or maximum net welfare or benefits." Although such a metric has yet to be devised and interpersonal utility comparisons are illegitimate, most economists have found that benefit-cost analysis of, say, public investments are extremely useful in making more rational decisions about them. Such analyses are direct offsprings of Bentham's attempt to create a more rational, positive and normative social science and indeed a basis for a rational moral, ethical and legal code. For a brief exposition, see Scott Gordon, "Utilitarianism," in *The history and philosophy of social science* (London: Rutledge, 1991), pp. 248–70.

65. George W. Wilson, "The Effect of Rate Regulation on Resource Allocation in Transportation," *The American Economic Review*, May 1964, pp. 167–68.

66. U.S. Department of Commerce, *Modern Transport Policy: Documents Relating to the Report of the Presidential Advisory Committee on Transport Policy and Organization and Implementing Legislation* (Washington, D.C.: Government Printing Office, 1956). (The Weeks Report).

67. George W. Wilson, "The Weeks Report Revisited," *American Economic Review*, March 1959, pp. 130–31.

68. George W. Hilton, *The Transportation Act of 1958*, p. 204.

69. Interstate Commerce Commission, *Railroad Passenger Train Deficit*, Docket No. 31954, Decided May 18, 1959, p. 479.

70. Ibid., p. 484.

71. George W. Hilton, *The Transportation Act of 1958*, p. 118.

72. Cited in ibid., p. 119.

73. Interstate Commerce Commission, *Railroad Passenger Train Deficit*; Report prepared by Howard Hosmer, Hearing Examiner, et al., ICC Docket No. 31954, 1959. (The Hosmer Report).

74. Civic Aeronautics Board, Reports to Congress, *Annual Report, 1977* (Washington, D.C.: United States Government Printing Office, 1978), pp. 140–43.

75. For some data and discussion see Interstate Commerce Commission, *The Intercity Bus Industry* (Washington, D.C., May 1978), and Transportation Policy Associates, *Transportation in America*, 2nd ed. (Washington, D.C., 1984).

76. Interstate Commerce Commission, *The Intercity Bus Industry*, p. 45.

77. Ibid., pp. 93–97.

78. The Weeks Report, pp. 1–3.

79. See for example, S. Huntington, "The Marasmus of the I.C.C.: The Commission, the Railroads, and the Public Interest," *Yale Law Journal*, April 1952; M. Bernstein, *Regulating Business by Independent Commission* (Princeton: Princeton University Press, 1955); and many others.

80. United States Senate, Special Study Group on Transportation Policies in the United States, *The Doyle Report: National Transportation Policy* (Washington, D.C.: Government Printing Office, 1961).

81. Ibid., p. 38.

82. Ibid., pp. 155–57.

83. Ibid., p. 31.

84. Ibid.

85. Ibid., p. 161.

86. Ibid.

87. Ibid., pp. 434–35.

88. Ibid., p. 322.

89. [illegible]

90. Ibid., p. 323.

91. Ibid.

92. Ibid., p. 326.

93. Ibid.

94. Ibid.

95. Thomas K. McGraw, *Prophets*, p. 206.

96. The Doyle Report had this to say about multiple considerations that the ICC felt it had to examine (as noted earlier in Section 4 of this study) as an aspect of the "grand design": "Further, because there are so many factors to be taken into account by the I.C.C., from a national policy aspect as well as from the aspect of the relative importance of the conflicting evidence adduced in connection with any particular application, the I.C.C. can decide almost any case just about as it pleases and, by leaning upon, first, one aspect, and in another case, upon another aspect of our transportation policy, successfully withstand almost any scrutiny of the courts." (The Doyle Report, p. 124.)

97. U.S. Department of Transportation, U.S. Federal Railroad Administration, *Report on the Potential for Integrating Rail Service Provided by the National Railroad Passenger Corporation with Other Modes* (Washington, D.C.: Government Printing Office, 1976).

98. Hoogenboom, *The History of the I.C.C.*, p. 164.

99. U.S. Department fo Transportation, U.S. Federal Railroad Administration, *Report on the Potential for Integrating Rail Service*, p. 2.

100. Ibid., p. 4.

101. Cited in Department of Commerce Memorandum, July 16, 1964 entitled "Summary of Legislative Activities Growing Out of the President's Transportation Message of 1962."

102. George W. Wilson, *Economic Analysis of Intercity Freight Transportation*, p. 272.

103. *Economic Report of the President*, January 1966, (Washington, D.C.: Government Printing Office), p. 128.

104. Bradley Behrman, "Civil Aeronautics Board," in *The Politics of Regulation*, ed. James Q. Wilson (New York: Basic Books Inc., 1980), p. 90.

105. For details and a methodological critique see G. W. Wilson, *Economic Analysis of Intercity Freight Transportation*, pp. 236–50.

106. Martha Derthick and Paul J. Quirk, *The Politics of Deregulation* (Washington, D.C.: The Brookings Institution, 1985) p. 38.

107. Ibid.

108. George W. Wilson, Memo, June 1966.

109. Robert C. Lieb, *Transportation*, 3rd ed., (Reston, Virginia: Reston Publishing Company, 1985), p. 47.

110. This story has been well detailed in several important sources, and will only be briefly related here. See McGraw, *Prophets,* chapter 7; Derthick and Quirk, *The Politics;* and James Q. Wilson, (ed.), *The Politics of Regulation* (New York: Basic Books, 1980), chapter 3.

111. Cited in McGraw, *Prophets,* p. 267.

112. A-J-W stands for the initials of the three authors, H. Averch and L. Johnson, "The Firm Under Regulatory Constraint," *American Economic Review,* December 1962, and S. Wellisz, "Regulation of Natural Gas Pipeline Companies: An Economic Analysis," *Journal of Political Economy,* February 1963. The "A-J-W effect" refers to the conclusion of these authors that rate of return regulation of a monopolist producing a single homogeneous product and seeking to maximize absolute profits will lead to resource misallocation in the sense that more capital, relative to labour, will be used than is needed for efficient production if the allowable rate of return is set between the opportunity cost of capital and the unconstrained maximum profit rate of return. A substantial literature grew up following these seminal articles in the early 1960s, most of which has little relevance to transportation regulation. For details see G. W. Wilson, *Economic Analysis of Intercity Freight Transportation,* pp. 186–98.

113. Alfred E. Kahn, *The Economics of Regulation* (New York: Wiley, 1970), 2 vols.

114. Passenger-mile data from U.S. Dept. of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1990,* 110th ed., (Washington, D.C.: Government Printing Office, 1990), p. 597: Data on number of trips refer to vacation trips only. See Steven A. Morrison and Clifford Winston, "The Demand for Intercity Passenger Transportation," *Transportation Research Forum, Proceedings,* 1983, pp. 526–34.

115. See U.S. *Bus Regulatory Reform Act,* U. S. Congress Public Law 96-261, 1982.

116. For details of these efforts see Edward L. Ramsdell and Imogene R. Burns, "Current Trends in the Health and Structure of the Intercity Bus Industry," *Transportation Research Forum, Proceedings,* Vol. xxvii, no. 1, 1986 and Clinton V. Oster and C. Kurt Zorn "Franchising as a Response to Increased Competition in the Intercity Bus Industry," ibid., p. 59 ff.

117. Oster and Zorn, "Franchising," p. 60.

118. Ibid., pp. 64–65.

119. See Itzkoff, *Off the Track;* Hilton, Amtrak; L. E. Tobey, "Costs, Benefits, and the Future of Amtrak," *Transportation Law Journal,* Vol. 15, 1987, pp. 245–302 and many others.

120. For details see Hilton, *Amtrak,* pp. 15–17, Tobey, "Cost Benefits," pp. 253–57.

121. U.S. Department of Transportation, U.S. Federal Railroad Administration, *Report on the Potential for Integrating Rail Service,* p. 39.

122. Ibid.

123. U.S. Public Law 94-280, 1976.

124. National Transportation Study Commission, *National Transportation Policies Through the Year 2000* (Washington, D.C.: Government Printing Office, 1979), p. 250.

125. A. E. Kahn, "Deregulation: Looking Backward and Looking Forward," Yale Journal on Regulation, Vol. 7, no. 2, Summer 1990, especially pp. 340 ff. Lieb, *Transportation*, Table 15-1, p. 317 shows a higher average number of carriers on various route types in July 1983 than July 1978: Adrangi, Gritta and Chow show reduced concentration levels for the industry as a whole by three major indicia of concentration for the post-deregulation period 1976–1985 in "Deregulation and Concentration in Air Transportation," *Transportation Research Forum: Proceedings*, Vol. xxvii, no. 1, 1986, p. 6 ff.

126. A. E. Kahn, "Deregulation," pp. 343–44.

127. Ibid., p. 348.

128. *The Economist*, July 20, 1991, p. 82.

129. For a sympathetic and reasonable case see Tobey, "Cost Benefits."

130. Itzkoff, *Off the Track*, p. 131 citing the Executive Director of the Pennsylvania High Speed Intercity Rail Passenger Commission.

131. J. B. Hopkins, "Innovative Technology for Intercity Passenger Systems," in *Passenger Transportation in High-Density Corridors*, SPA-90-1. VNTSC, Cambridge, Mass., November 1990, p. 6.

132. M. Walrave and A. de Tessieres, "The French TGV System — Achievements To-Date and Future Developments," *World Conference on Transportation Research, Proceedings*, 1986, Vol. 2, pp. 1063–81.

133. U.S. Department of Transportation, "Assessment of the Potential for Magnetic Levitation Transportation Systems in the United States," June 1990, pp. 17–18.

134. Ibid., pp. 301–02.

135. In Steven A. Morrison, "The Value of Amtrak," in *Canadian Transportation Policy*, edited by David Gillen, p. 104.

136. Ibid., p. 110.

137. U.S. Department of Transportation, *Moving America, New Directions, New Opportunities* (Washington, D.C.: Government Printing Office, 1990).

138. Ibid., p. 2.

139. Ibid., p. vi.

140. Ibid., p. 26.

141. Ibid., p. 43.

142. Ibid., p. 51.

143. Ibid., p. 53.

144. Ibid., p. 105.

145. Hansen, "U.S. Intercity Passenger Transportation," p. 21.

146. *New York Times*, June 20, 1991, p. 1.

147. Senator Daniel Patrick Moynihan, "Senate Overwhelmingly Passes Revolutionary Surface Transportation Act, 91-[illegible] Release, June 19, 1991, p. 1.

148. Fred P. Nix, "Road-user Costs: Report on Exploratory Research," *Journal of the Transportation Research Forum*, Vol. XXX, no. 1, 1989, pp 18–27; and Peter Bein, "Canadian Experience with HDM3 in Road Transportation Management," ibid., pp. 9–18.

149. For details see Nix, "Road-user Costs," and George W. Wilson, *Economic Analysis of Intercity Freight Transportation*, pp. 91 ff.

150. Nix, "Road-user Costs," p. 26.

151. Interestingly enough the resurrection of Ramsey pricing was first in connection with efficient highway user-charges. See A. A. Walters, *The Economics of Road User Charges*, World Bank Staff Occasional Papers, no. 5, 1968, pp. 115–17. W. J. Baumol and D. F. Bradford, "Optimal Departures from Marginal Cost Pricing," *American Economic Review*, June 1970, facilitated the revival of Ramsey pricing.

152. This is not of course unique. The U.S. has viewed various aspects of Canadian policy as worthy of emulation. The most recent illustration is in the realm of medical and health insurance. But historically Canadians have seen themselves as, perhaps too often, followers of the policies and activities of the large, influential giant to the south. It is only in this sense that the transportation policy change in 1967 can be seen as paradoxical or at least one of a limited number of cases where Canada was well ahead of the United States in a major shift of public policy. The sequence is usually the other way around.

153. It could not be proved, for example, that greater reliance on market forces would improve things for shippers, travellers or many carriers. This was a theory about which no one could be absolutely certain. As such it was fair game for opponents to allege that those advocating the changes were "academics," most of whom had "never met a payroll" or misguided individuals with no personal stake in the outcome who did not mind experimenting with other peoples' interests.

154. Canadian Transport Commission, Motor Vehicle Transport Committee, *Report of Investigation and Decision, Pursuant to Section 27 of the National Transportation Act, in the matter of an objection by the Trucking Association of Quebec Inc. to the proposed acquisition of Chalut Transport (1974) Inc. by Canadian National Railways indirectly through its subsidiaries*, Decision No. MV-27-32 (M-76-2), June 1976, Appendix I.

155. Testimony before the Interstate Commerce Commission, Finance Docket No. 30500, "Norfolk Southern Corporation — Control — North American Van Lines, Inc.," Vol. III, filed August 1984, pp. 00149–00150.

156. For some of these see Trevor D. Heaver, "The Changing Role of Government Intervention in Canadian Transportation," Centre for Transportation Studies, University of British Columbia, April 1988 (mimeographed).

157. For an outline and elaboration see Wilson, *Economic Analysis of Intercity Freight Transportation*, pp. 187–207 where the A-J-W effect and other theories of regulatory consequences are discussed.

158. Richard Soberman, "Canadian Passenger Transportation Policy," in *Canadian Transportation Policy*, edited by Gillen, p.14.

159. Ibid., p. 17.

160. Ibid, p. 16.

161. See for example, Richard M. Soberman and Adil Cubukgil, "A Model for the Privatization of Rail Passenger Services in Canada," *Proceedings of the Canadian Transportation Research Forum*, May 1989, pp. 111–23.

162. See section 1.

163. Paraphrase of statement by Joseph B. Eastman in preface to U.S. Department of Commerce, *Passenger Traffic Report*.

164. See C. Winston, "Conceptual Developments in the Economics of Transportation: An Interpretive Survey," *Journal of Economic Literature*, March 1985 and Wilson, "Economic Analysis of Transportation: A Twenty-Five Year Survey," for examples along these lines.

165. Joseph A. Schumpeter, *History of Economic Analysis* (New York: Oxford University Press, 1954), p. 978.

166. William J. Baumol and David F. Bradford, "Optimal Departures from Marginal Cost Pricing," p. 277.

167. Schumpeter, *History*, p. 948.

## 3

# THE ROLE OF EQUITY CONSIDERATIONS IN THE PROVISION AND PRICING OF PASSENGER TRANSPORTATION SERVICES

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## I. INTRODUCTION: EQUITY AS AN OBJECTIVE OF GOVERNMENT POLICY

A precondition for discussing the role of equity in passenger transport services is a clear understanding of the role of equity in more generally defined economic policy. Not only does this provide a normative basis for considering equity in this special context, but it also makes clear how the various instruments for pursuing equity are interdependent. The most general form in which equity objectives can be addressed is by monetary transfers based on some index of well-being or need. The traditional tax-transfer mechanism appropriately designed to take household and personal circumstances into account can be used for this purpose. The use of other narrower instruments, such as in-kind transfers, subsidies on particular goods or services, or regulations to target specific groups (each of which may be relevant for the case of passenger transport services), presumes that general taxes and transfers are in themselves inadequate. It is helpful to know precisely if and why this inadequacy exists.

We approach this general question in two steps. First, we consider the role of equity as an objective of government policy. This involves outlining the role of government in a market economy and seeing what this implies for equity as an objective among other objectives of government, especially efficiency. Second, we consider the instruments that might be used to achieve equity objectives most effectively. Subsequently, we apply these principles to the particular case of passenger transport services, and draw some tentative policy conclusions.

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The reader is forewarned that some of the discussion in the early sections is a bit abstract, though not difficult. This is not intended to obscure the issues, which ultimately require us to make rather practical judgments. Instead, the purpose of the discussion is to put the judgments into a broader context to avoid the temptation of making simplistic decisions whose broader implications are not fully understood.

It is important to stress at the outset that any policy conclusions can only be tentative because in the realm of equity, value judgments are unavoidable. Depending on the value judgments one is prepared to accept, the policy implications can differ dramatically. This will become especially clear in the first two sections of this paper. Indeed, this will be true of economic policy evaluation more generally. Except in rather special circumstances, the role of equity objectives cannot be ignored, and not all persons are likely to agree with the judgment made in any particular case. This is also likely a relevant consideration in the passenger transportation case as well.

## 1. THE OBJECTIVES OF GOVERNMENT ECONOMIC POLICY

The evaluation of economic policy involves comparing the allocation of resources under alternative policies and ranking them according to some criterion. Ideally, we would like to use a criterion which is as objective or scientific as possible. However, it turns out to be impossible to avoid making value judgments a part of the criterion. In what follows, we summarize how value judgments enter into economic policy evaluation according to modern welfare economics.

We begin with the bare minimum value judgments that are taken as being "maintained hypotheses" in much of the literature. These are the assumption of *individualism* and the *Pareto principle*.

Individualism means that what ultimately counts in evaluating policy is its effect on the well-being of individuals in society. This is opposed to some organic view of society in which what counts are the effects of the policy on, say, institutions or on abstract principles which have a value in their own right (for example, freedom of speech, non-discrimination, etc.). The notion of individualism typically carries with it the assumption that individuals are the best judge of their own well-being, referred to as the property of *non-paternalism*. There are circumstances in which the principles of individualism and non-paternalism are difficult to sustain. For example: Should children and people with mental disabilities be treated non-paternalistically? Should households be treated differently than individuals? Fortunately, the answers to such questions are probably of secondary importance to us for transportation issues.

The Pareto principle holds that, if a policy change makes at least one person better off and no one worse off, it represents a social improvement. It seems to be a reasonable requirement, although there are circumstances in which it may be said to conflict with other widely held principles.[1]

If policies could be ranked according to these two criteria alone, policy evaluation would be a relatively simple matter. Unfortunately, that will not be the case. Most policies violate the Pareto principle; that is, they make some persons better off and others worse off. Thus, something more than these two principles will be needed to rank policy alternatives. Economists who are not prepared to make further value judgments have attempted to avoid the issue in one of two ways. In some instances, they have attempted to extend the Pareto criterion to circumstances in which, although some persons are made better off and others are made worse off, the former could hypothetically compensate the latter and still be better off. Alternatively, they have simply ignored redistributive considerations and treated a dollar as being worth the same no matter to whom it accrues. Consider each in turn briefly.

According to the first criterion, if the gain to one person measured in monetary terms exceeds the loss to another, it seems reasonable to suppose that the gainer could compensate the loser and still be better off. If so, the *hypothetical compensation test* is said to be satisfied and a Pareto improvement should be potentially possible. This notion of a *potential Pareto improvement* has been taken by some to be synonymous with an efficiency gain. If we can come up with monetary measures of changes in individual well-being, it might seem that, by simply summing up the gains and losses thus measured, we could say whether a policy change improves efficiency of the economy. (We return below to a discussion of how we can measure gains and losses in monetary terms.) However, this is not a satisfactory way to deal with the matter for several reasons:[2]

i. The criterion of a potential Pareto improvement is itself ambiguous. Whether the hypothetical compensation test is satisfied or not depends upon the form which the compensation is imagined to take. In the literature, there are various assumptions about the nature of the compensation. The early literature based on Kaldor (1939) assumed that the compensation simply reallocated an existing bundle of goods without any change in production. Later analyses assumed that lump-sum income transfers were used and that the compensation therefore caused production changes to take place. Finally, the compensation might only be possible using distorting taxes and transfers, in which case different production responses could occur. For a given policy change being evaluated, whether or not a hypothetical compensation test is satisfied could depend upon which form of compensation is hypothesized. For example, if the gainers could make lump-sum transfers of income to the losers, the test might be satisfied, whereas if the compensation involved redistributing the given bundle of goods, or if transfers could only be made using distorting taxes, it might not.[3]

ii. For any given form of compensation, the ranking of alternatives by the hypothetical compensation test is bound to be incomplete, and may well be contradictory depending upon the starting point. That is, in comparing the pre-policy and post-policy outcomes for any given policy change, the compensation test may not be satisfied in going from either one to the other, so the ranking is incomplete. Or, it may be satisfied for both.[4]

iii. The compensation test is virtually impossible to implement from market data. For example, it is well known that aggregating welfare measures such as consumer surpluses over persons will not indicate whether or not the compensation test is satisfied.

iv. Perhaps most important, if the compensation is not actually paid, a policy change will in fact make some persons better off and others worse off. The fact that compensation could have been paid will not constitute to many observers an unambiguous gain in social welfare. To evaluate it as a gain in social welfare requires trading off the gains to the gainers with the loss to the losers. In other words, it involves an interpersonal comparison of welfare, something which the compensation test was designed to avoid.

Despite the unsatisfactory nature of the compensation criterion, many economists have nonetheless advocated, either explicitly or implicitly in their practice, the simple summing up of gains and losses in monetary terms to various persons without regard to whom they accrue.[5] Various justifications may be made for this. One is an appeal to the separability of redistributive from efficiency concerns. As we discuss below, there are certain circumstances in which this is a perfectly defensible position. Indeed, part of our later discussion details when that is the case for passenger transport services. Basically, this position segregates all additional value judgments into a particular set of redistributive instruments, rather than avoiding value judgments entirely. Another justification for treating the dollar gains as having the same weight for all is that pure ignorance or lack of information may prevent one from desegregating the aggregate gains to persons of varying circumstances. Finally, some persons have argued that, over the long run, the chances of being a gainer and being a loser will roughly cancel out, so it is pointless to try to treat them differently. For many of the issues we address below, these latter two arguments clearly do not apply.

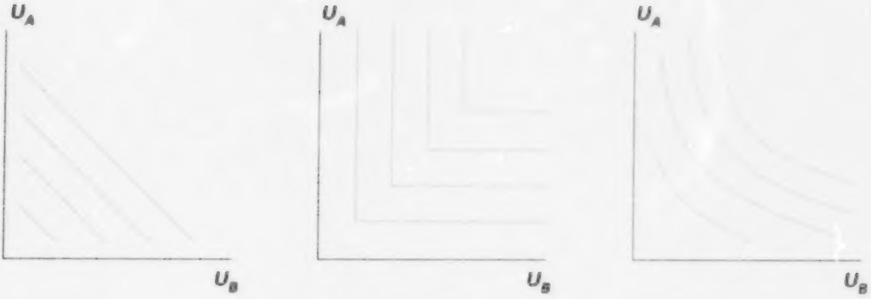
One is left with a fairly convincing case for going beyond the two maintained hypotheses of individualism and the Pareto principle for evaluating policies. The question then becomes what additional judgments need be made. There is bountiful and highly technical literature on *social welfare functions* which addresses precisely this issue. Much of it stems from the highly influential, but distressingly agnostic, work of Kenneth Arrow (1951). Arrow formulated the famous Arrow Possibility Theorem which, roughly speaking, says the following. Suppose we want to compare alternative allocations of resources and the only information we have available is the rankings of those alternatives by the persons in the economy. Suppose further that we place no restrictions on the form of the individual rankings, we require the Pareto principle to be satisfied, and we impose a technical requirement known as the *independence of irrelevant alternatives*. The latter basically says that the ranking of any two alternatives is independent of the availability of any other. Then, the only procedure which can be guaranteed to give a rational ranking of the alternatives is a ranking in accordance with the preferences of only one person, that is, what is referred to as a "dictatorship."

The Arrow Possibility Theorem has spawned a great deal of research, much of it attempting to relax its requirements so as to avoid the dictatorship outcome. A brief survey of some of the consequences of this literature is presented in the Appendix. For our purposes, we will simply avoid the conceptual issues involved in taking collective decisions by following the conventional procedure of assuming that society's ethical norms can be represented by a *social welfare function*. A social welfare function is simply a function which aggregates the utilities of the members of the society.[6] In making a social welfare function operational for policy evaluation purposes, two main challenges emerge. The first is to obtain a measure of individual utility. Economists have devised a way of representing individual utility levels in monetary terms and this is referred to as a monetary measure of *real income*. The principles of representing utility by monetary measures of real income is also discussed briefly in the Appendix.

Given a monetary measure for utility levels, the next challenge is to devise a way to trade off or weight utility or real income levels obtained by different persons in order to aggregate them into a measure of social welfare. As is pointed out in the Appendix, when aggregating real incomes using a social welfare function, a key ethical property of the social welfare function is the degree of inequality aversion. Depending on the degree of inequality aversion, quite different degrees of redistribution can be called for. The three panels of Figure 1 depict indifference maps for three different social welfare functions with differing degrees of inequality aversion. All satisfy the properties listed above. In panel (a), the so-called *utilitarian* social welfare function is shown. According to this function, all that counts is total utility, not its distribution between the households.[7] It is said to have no aversion to inequality. Panel (b) shows the opposite extreme of complete aversion to inequality. It is referred to as the *maxi-min* social welfare function.[8] Panel (c) shows an intermediate case in which there is some aversion to inequality. These social welfare indifference curves can be used to rank alternative possible outcomes.

To illustrate the consequences of these differing attitudes towards unequal utility levels, consider the following example drawn from Sen (1973). Suppose there is a fixed amount of income to be redistributed between two persons, and suppose that the redistribution can be done in a costless way. That is, there is no inefficiency associated with the redistribution. Suppose that the two persons differ systematically in their utility functions. In

Figure 1

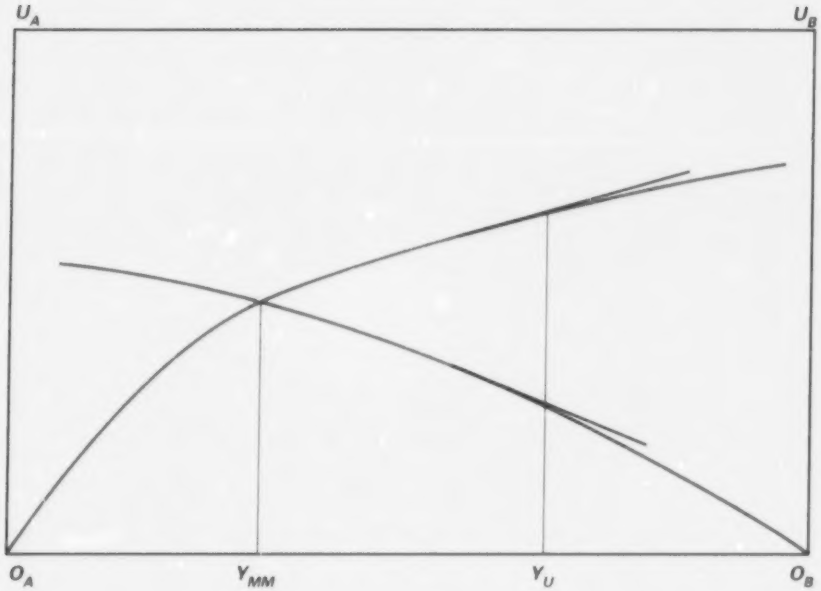


**(a) Utilitarian** **(b) Maxi-min** **(c) intermediate case**

particular, person *A* obtains more utility from a given amount of income than does person *B*. We will say person *A* is the more efficient utility generator. It may be that *B* is disabled or less healthy. Consider now how the given amount of total income should be allocated between the two individuals under the various social welfare functions. Figure 2 can be used to do so.

Figure 2 depicts the utility levels associated with differing levels of income for the two persons, with *A*'s utility drawn from the origin labelled $O_A$ and *B*'s drawn from that labelled $O_B$. Under the maxi-min social welfare function, the utility levels of the two persons would be equalized. The distribution of income $Y_{MM}$ would achieve this. Notice that, given the differences in the ability to convert income to utility, this would require income to be distributed in favour of the less-efficient utility generator, *B*. This may be contrasted with the utilitarian case. Here, income is distributed between the two such that the marginal utilities are equal. This is shown as the distribution $Y_U$ where the slopes of the utility functions are equal. Note that, in this case, the income distribution is opposite to the maxi-min case. Person *A* gets more than person *B*; also, person *A* ends up with a higher level of utility. The sum of utilities is maximized independent of its distribution. The intermediate case is not shown on the diagram, but obviously it will have a distribution of incomes between $Y_{MM}$ and $Y_U$. More generally, the greater the aversion to inequality, the more income will be allocated to person *B* relative to person *A*. It should be obvious from this that value judgments play an important role in redistributive policy.

Figure 2



This example relied on differences in utility functions to generate ambiguities about the optimal redistributive policy. In those examples, if the two persons had identical utility functions, full equality would have been the prescription.[9] However, it is easy to devise circumstances in which, even with identical utility functions, redistributive policy depends critically on the form of the social welfare function. This is discussed with reference to two further cases in the Appendix. There it is shown that simply making income variable by, say, allowing persons to decide their labour supplies, makes the extent of redistribution heavily dependent on the degree of inequality aversion in the social welfare function. This will be the case even when non-distorting (lump-sum) redistributive transfers are allowed.

When the tax-transfer system itself imposes efficiency costs on the economy, the amount of progressivity in the tax is reduced for any social welfare function. The examples in the Appendix clearly show that the extent of redistribution through the tax-transfer system is potentially quite limited when efficiency considerations are taken into account. I do not draw from that the conclusion that redistribution is necessarily limited; only that redistribution through the tax-transfer mechanism might be. As discussed below, there are many other instruments that governments use for redistributive purposes. By their nature, many of them do not have the same efficiency costs involved. Instead, the extent of their use is determined by pure equity considerations.

A key issue that arises in evaluating and implementing economic policy is the extent to which the objectives of equity and efficiency can be separated. In an important general sense, the two cannot be separated. All policy decisions affecting resource allocation can, in principle, affect both, and, if government were a single monolithic agency, that agency would want to evaluate its decisions from a social welfare point of view incorporating both equity and efficiency considerations. However, the public sector itself is a highly decentralized organization in which resource allocation decisions are taken more or less independently in many different areas. In such a setting, it is more natural to ask whether each of these individual decisions should be taken with equity as well as efficiency objectives in mind.

Although the literature on this is not extensive, a good case can be made for continuing to follow the advice of Musgrave (1959) and think of the allocation and distribution branches of government as being essentially separate branches. Distribution decisions by their nature tend to be of somewhat broader applicability than allocation decisions. The latter are taken in the first instance at a more decentralized level. Most economists would agree that decentralized decision making on public sector resource allocation, including cost-benefit analysis, should basically be done with efficiency in mind. Equity objectives should be pursued by a central agency with a broader mandate. This agency could be responsible for setting tax-transfer policies and the regulatory framework, and these would act as constraints on those taking resource allocation decisions. Our discussion of equity considerations that follow are made from that perspective.

## 2. THE ROLE OF GOVERNMENT IN A MARKET ECONOMY

The above discussion focussed on the criteria that might be used to rank alternative allocations of resources, particularly those in which the distribution of utilities among households differed. We showed that very different rankings could occur depending on the value judgments one chose to make, in particular, depending on the degree of aversion to inequality in the social welfare function. Ultimately, we will consider the way in which the government can achieve whatever redistributive objectives it wishes. However, before so doing, it is useful to review the prior question of the role of government in a market economy.

The conventional argument for government activity in allocating resources is a rather negative one, based on the notion of market failure. It is well known that, under certain circumstances, the decentralized decision making of the market has certain attractive properties in achieving efficiency in the allocation of resources. In particular, in idealized circumstances, the market, if operating competitively, will yield a Pareto efficient outcome. The role for government rests on two things — first, that those idealized circumstances may not hold (the market-failure argument), and, second, that the market outcome, no matter how efficient it is, may not be equitable. The ability of the government to intervene successfully depends upon how benevolent one views the government to be as well as how efficient it is (that is, how much *government failure* there is). Economists vary widely in their judgments of these issues, and therefore of how interventionist they think the government should be. This is over and above the differences that may exist in value judgments different persons hold about the ideal amount of equity versus efficiency. We leave that as an open question and simply recount the sources of market failure, thinking of them as necessary, though not necessarily sufficient, conditions for government intervention.

The sources of market failure and inequitable outcomes are fully documented in the public finance literature so we need do little more than list them here. They include the following:

### Public Goods

Markets cannot be relied on to provide efficient amounts of goods which are simultaneously consumed by all. This is certainly true when the public goods exhibit the property of "non-excludability," that is, when non-paying users cannot be excluded from use. However, it is generally also true when excludability is possible. Even if persons could be excluded from using a public good, efficiency suggests that they should not be since the property of publicness implies that additional users can be added at no cost to society. This is the traditional argument for government provision of goods and services.

### Externalities

Related to the above is the case where activities of some firms or households cause beneficial or detrimental effects which do not get priced for one reason or another. Governments may respond by assuming responsibility for their provision, or for using corrective mechanisms such as taxes/subsidies or regulations.

### Economies of Scale

The cost efficient scale of output of a good or service may be large relative to the market it is serving, in which case competition will not prevail. Again, government may undertake to provide the item itself, or it may regulate private behaviour. (Alternatively, it may do nothing as some economists would advocate.)

### Unemployed Resources

There may be problems of coordination on some markets which imply that some resources go unused. Examples of this include labour, housing and capital. There have been some theories to suggest that there are systematic sources of inefficiency on these markets which government intervention can, in principle, address (for example, search externalities on labour and housing markets).

### Absence of Full Markets in Uncertainty

A fully efficient allocation of resources requires that risks be fully traded and diversified away to the extent possible. This may not occur for a variety of reasons. For one, markets may be simply too thin for some types of risks, given the transaction costs involved. For another, a great deal of risk may be induced by uncertainty of government behaviour itself. Presumably this is not fully diversifiable. Finally, risk markets may not function perfectly because of informational problems as discussed in the next category.

### Asymmetric Information

It is now widely acknowledged that many markets are characterized by what is referred to as asymmetric information problems, meaning that one side of the market is better informed than the other. This implies that resources will not be allocated in their most efficient way. The two most common versions of this are *moral hazard* and *adverse selection*, and they have been analyzed most extensively in insurance markets. However, they apply to many sorts of markets, such as the markets for labour and capital. Basically, moral hazard refers to a situation in which one side of the market can take actions which affect the outcome, but which cannot be observed by the other side. Market outcomes may well involve non-optimal amounts of such actions. Adverse selection occurs when participants on one side of the market differ from each other in some characteristic that is not observable to the other side. Such markets are known to result in inefficient outcomes, and perhaps not even to have equilibrium outcomes. There is a considerable literature on market failure resulting from adverse selection and moral hazard. What has not been established in the literature is whether this sort of market failure can be averted by public sector intervention. For example, the public sector is likely to face exactly the same sorts of difficulties in becoming informed as the private sector. Thus, it may not be possible for the government to improve upon the market solution for such things as health and unemployment insurance, at least on efficiency grounds. We have to look elsewhere for a rationale for government intervention in these areas. The most likely reasons have to do with equity arguments which the final two items address.

### Unequal Incomes

Even if the market were allocating resources in a perfectly efficient way, the outcome may not be regarded as being optimal, if it results in allocations which are unequal. Governments may therefore wish to interfere in order to redistribute resources on equity grounds. These last two categories look at equity in two related ways. One indicator of inequality is simply differences in observed incomes among households generated by the market. These differences may come from several sources including the following: abilities, inheritances, human capital accumulated, work effort and pure market luck. Virtually all governments engage in tax-transfer policies which redistribute income from the better-off to the worse-off households. However, there is a limit in the extent to which redistribution on the basis of income can be effective in achieving equity. There are two basic reasons for this, both of which have been referred to already. The first is that income may be a very imperfect indicator of well-being, especially since it does not reflect differences in, say, leisure. The second is that, for any given household, income is an endogenous concept. Persons can change their income by altering their behaviour thereby causing inefficiency. The public finance literature has argued quite convincingly that the extent of redistribution that one can achieve by income-based instruments alone is likely to be quite limited.[10]

### Social Insurance

There are, however, other arguments for redistribution which are related to the above but which recognize the possible usefulness of other sorts of instruments. The literature on redistributive income taxation tends to emphasize differences in the ability to earn income as a source of inequality. There are many other characteristics which also can result in utility differences and which can be (and, in practice, are) used as a basis for redistribution. They include such things as health and physical characteristics, employment status, location of residence and date of birth. Redistribution based on these features is sometimes referred to as social insurance for the following reason. The endowment each person brings with him or her at birth is largely a matter of luck. If individuals could insure themselves against being unlucky in these characteristics, they surely would. However, they obviously cannot do so on ordinary insurance markets. Insurance can only be purchased before the event being insured against is revealed and, in this case, that occurs at birth. Thus, they can only be "insured" against being unlucky at birth after the fact by the public sector. The conceptual device of putting oneself behind the "veil of ignorance," that is, imagining not knowing what one's characteristics are going to be, and asking what kind of insurance one would be willing to purchase, is often used as a normative justification for compensating persons for being unlucky at birth. This might be used as the justification for public health insurance, unemployment insurance, assistance to persons with disabilities, intergenerational transfers in favour of unlucky cohorts, etc. In each of these cases, the object of redistribution is somewhat different than income. Depending upon how sharply the government can observe the underlying characteristics, the possible induced inefficiencies in behaviour may be greater or less.

We take these roles for government in a market economy as given. The primary issues we wish to address concern how government achieves the equity objectives in practice, and how this may apply to the special case of passenger transportation services. The following two sections address those in turn.

# II. INSTRUMENTS FOR ACHIEVING EQUITY IN THE ALLOCATION OF RESOURCES

Virtually everything governments do has a redistributive effect. What is perhaps less widely recognized is the extent to which redistribution is the main motivation behind various government programs. Public finance theory, which has tended to focus on efficiency analysis, has largely ignored this, at least until quite recently. We are used to thinking of the tax-transfer mechanism as the means of achieving distributive equity, with most other functions of government aimed at efficiency or stabilization issues. This way of looking at the role of government is typified by the public finance textbook device of separating government functions conceptually into allocation, distribution and stabilization branches. Government expenditures on goods and services are then thought of as fulfilling an allocative function, while distributive goals are met using taxes and transfers. However, closer inspection reveals that many important programs on the expenditure side of the budget are at least partly redistributive devices. This section simply summarizes all the instruments that fall into that category.

## 1. TAXES

Many of the taxes used by governments are structured to take distributional objectives into account. The main exceptions might be specific excises, the corporation income tax, and, to some extent, customs duties. Specific excises and customs duties are levied for particular purposes, such as correcting for externalities, industrial policy and user-fees. The corporate tax is best thought of as a withholding tax on behalf of the personal tax and, as such, its redistributive effects are addressed through the personal tax system by the method of integration (for example, the dividend tax credit). It also serves as a device for extracting revenues from foreign-owned firms by exploiting the international tax crediting system.[11] At the provincial and local levels, there are other tax types such as property taxes, licences and user-fees. These are also directed to non-distributive goals.

The two main taxes that are of relevance for redistribution are the individual income tax and general sales taxes (both federal and provincial). Each of these has provisions that are specifically redistributive in intent. Consider each in turn.

**Individual Income Tax**

There are three main ways in which the personal income tax is designed to take equity into account. The first is in measures which adjust the base for personal circumstances, such as number of dependents, disability and age.[12] The rationale for many of these measures is to make taxable income a better measure of welfare or discretionary income and thereby improve the horizontal equity of the tax system. As discussed earlier, this is justified by the notion that different persons require differing amounts of expenditures to achieve the same level of utility. As the Carter Royal Commission Report put it, different persons have differing levels of non-discretionary expenditures.

The second consists of deductions based on expenditures which are deemed not to be utility augmenting. These include the costs of employment, the cost of moving, educational expenses, day care expenses, charitable donations and medical expenses. These again are intended to address the horizontal equity issue by adjusting the base. The case of medical expenses, which includes those involved with disability, is an interesting one. It could be argued that persons who incur medical expenses and who receive the disability tax credit actually have different utility functions than others. Depending on the degree of inequality aversion one subscribes to, one might want to do more than simply make expenses for these persons tax-deductible. Doing the latter merely saves them the tax costs of the medical expenses they incur and does nothing to correct for the underlying disutility they live with as compared with healthy persons. If the degree of inequality aversion is high, one might want to transfer sizeable sums to persons with disabilities, especially since that is a characteristic which is relatively easily observable and not influenced by the behaviour of those involved.

The third component of the direct tax which addresses equity is the rate structure itself. Its degree of progressivity is a combination of the basic personal exemption and the structure of marginal tax rates on persons. In practice, it has been observed that the tax system as a whole has only limited progressivity in it.[13] On theoretical grounds, there are good reasons for this. As mentioned earlier, the vast literature on the optimal progressivity of the income tax, emanating from the seminal paper by Mirrlees (1971), has tended to support the view that, given the equity-efficiency trade-offs involved, the amount of redistribution that should be accomplished through the income tax system is more limited than one might believe. The fact that leisure and household production are sources of untaxed real income apparently restricts the optimal degree of progressivity considerably. Much of this literature is based on simulation procedures, and it would be beyond the scope of this paper to survey it fully. However, the results consistently tell the same message. We need not take from this the message that redistribution itself is of limited interest as a policy objective. As we point out below, there are many ways other than taxes that governments can redistribute, and some of them can be very effective.

## Indirect Taxes

A high proportion of taxes are levied from indirect taxes of a general sort. These include the new *Goods and Services Tax* at the federal level and the provincial retail sales taxes, all of which have as their intended bases some measure of the consumption of households. The first thing to note about general sales taxes is that their bases could be designed to be virtually identical to direct tax bases, if the government so desired. That is, if the government levied a reasonably comprehensive income tax on individuals, it could design the sales tax to be equivalent to an income base. This would involve including all consumer goods and services as well as net capital goods purchases.[14] Alternatively, if it taxed consumption at the personal level (which is not far from the truth under the current income tax system), the equivalent sales tax base could be purchases of goods and services used for consumption. In practice, of course, governments are somewhat inconsistent in their choice of direct and indirect tax bases, since they seem to prefer income for the former and consumption for the latter. However, the point is that they could, if they so desired, achieve the same base under either system.

This leads us to ask the fundamental question of the tax system. Why do we need both indirect and direct taxes in the system, if both can be levied on the same base? Why not just use one and save the separate cost of collection involved in having both? There are two answers to this — a theoretical one and a more practical one. The theoretical approach recognizes that there is a type of progressivity which can be achieved under a sales tax system which cannot be replicated under an income tax system. It arises because of the ability to implement a differential rate structure by commodities, such as charging lower tax rates (perhaps zero) on necessities and higher ones on luxuries. The main result of the theoretical literature is that, if the utility function of households is characterized by *separability* of goods from leisure, nothing is gained by having differential commodity taxes alongside an income tax.[15] To put it differently, the sales tax rate would be the same for all commodities and would be equivalent to a proportional income tax; thus, commodity taxation would be redundant with an income tax. Furthermore, even if separability did not apply, the government is unlikely to have the information to know the appropriate rate structure to use for the indirect tax system. Thus, the case for using an indirect tax alongside a direct tax on these grounds is weak.

The practical reason for having a direct-indirect tax mix lies elsewhere. The accepted reason is that evasion and avoidance of the income tax is possible, and the incentive to evade increases with the tax rate. Having a direct and an indirect tax in the same system thus fulfills two functions. First, it brings into the tax net on the expenditure side some persons who otherwise would have escaped taxation altogether because of evasion. Second, by providing a source of revenues to the government, it allows the tax rate on income to be lower, thereby reducing the incentive for evasion.

If we accept this as the practical reason for having a mix of direct and indirect taxes in the same system, then the case for introducing some progressivity into the system through the use of differential commodity tax rates can be made. Tax rates could justifiably be lower on goods with lower income elasticities of demand, if the possibility of evasion and avoidance is higher for high income persons. For example, the exemption for food and other necessities could be given theoretical justification. We return to this when we apply our discussion to passenger transportation.

## 2. TRANSFERS

Roughly one third of federal government program expenditures go to transfers to individuals. The most important of these are unemployment insurance, pensions and family allowances. At the provincial level, the major transfer program is for welfare. Welfare payments and family allowances are explicitly designed for redistributive purposes and complement the income tax system. Indeed, many have argued that they should be formally integrated with the income tax system in the form of a comprehensive negative income tax. This would rationalize the welfare system, treating it symmetrically with the income tax and avoid some of the existing system's adverse incentives on work effort.

The cases of unemployment insurance (UI) and public pensions are sometimes thought of as fulfilling other, non-redistributive, objectives. For example, the term "insurance" implies that UI is primarily a device for efficiency in labour markets. The term insurance applies to the notion of trading risk on the market. A purchaser of insurance is selling risk to an insurer who presumably is willing to take on the risk because of an ability to pool it among several purchasers. It is thus like a purchase of a commodity which both sides are willing to do voluntarily because it leads to a gain from trade, that is, to an efficiency gain. As long as there are no market failures, the private sector ought to be able to provide insurance efficiently. It is difficult, if not impossible, to make a convincing case based on efficiency or market failure grounds for public sector intervention in insurance markets. It is true that such markets may be plagued by such phenomena as adverse selection and moral hazard which prevent them from operating perfectly. However, the same informational problems which prevent the private sector from providing insurance efficiently apply equally to the public sector. This is as true for labour markets as for other markets. On theoretical grounds, it has been shown that private insurers could provide unemployment insurance almost as efficiently as the public sector.[16] It is more reasonable to view unemployment insurance as being implemented at least partly for redistributive reasons, and that partly accounts for it being a compulsory scheme. There has been a limited literature on the use of unemployment insurance as a redistributive instrument, and it is likely to be an area for research in the coming years.

Similar issues arise in the case of public pensions. There is no particular reason to think that public pensions are justified as corrective measures for inefficient private pensions. Other arguments for their existence must be made. Three are found in the literature. The first is simply the *positive economics* argument that unfunded public pensions are transfers from the young to the old. The median voter obtains a positive net present value from such programs because, being somewhere around mid-life, the expected future benefits are well in excess of the contributions for the rest of his or her working life. Thus, the median voter will continue to vote for unfunded public pensions despite the fact that they reduce long-run levels of welfare for future generations.[17]

The second is that unfunded public pensions, being vehicles for redistributing income across age cohorts, can be used to smooth out fluctuations in "luck" among different cohorts. This is referred to as *intergenerational* *risk sharing* and is sometimes used as a typical example of the principle of social insurance.[18] As mentioned above, social insurance is the phenomenon of insuring *ex post* against the various circumstances of one's birth. It is distinguished from ordinary insurance which is intended to insure against future contingencies.

The third is a rather more recent argument. It views public pensions as a form of compulsory saving, or, in other words, a form of provision of future consumption greater than that which the person would have acquired individually. This can be viewed as a kind of *in-kind* transfer, much like the provision of food and housing. The recent theoretical literature on optimal income taxation focussed on the desirability of using in-kind transfers alongside income taxation as redistributive devices. The argument is that, given the optimal income tax, social welfare can be improved by forcing additional consumption of commodities that are relatively more important to low-income earners. The forced consumption, or in-kind transfer, will only be effective to the extent that the good in question cannot be retraded. It has been used in the literature to date mainly in the context of pensions, education and health services.[19] This argument for pensions is really more applicable to compulsory funded pensions.

## 3. SOCIAL PROGRAMS

Governments in Canada also provide a number of social programs, many of which involve the provision of goods and services. Major examples of this include health care and services to the poor, those with disabilities and the elderly. We would argue that education at all levels can also be viewed as a sort of social program. One feature of these programs is that they support expenditures on what are essentially private goods and services. In the literature, they are referred to as *quasi-private* goods, since they are private but are provided in amounts fixed by the public sector. Being private, they could have been provided by the private sector. Indeed, in some countries, some of them are private, at least to some extent (for example, health care in the United States).

If one investigates why these quasi-private goods are provided publicly rather than being left to the private sector, the answer largely turns on their redistributive properties. There may be some efficiency arguments for public intervention revolving around externalities of various sorts, but they are hardly enough to warrant the massive public intervention that we see in most industrial countries. It seems more appropriate to view public provision of health, education and welfare services as being instruments for redistribution. Indeed, from this point of view, they may accomplish at least as much as the tax-transfer system itself. Whereas the tax-transfer system tends to be restricted to redistributing according to income, these other programs, like UI and Old Age Security (and the Guaranteed Income Supplement), redistribute according to some other characteristic, such as health status or need. They can be viewed as types of social insurance which compensate persons for some characteristic which they have acquired independent of their economic activity. Many of these programs can be implemented effectively with adverse behavioural incentives that are not as severe as with the tax-transfer system based on income. This implies that the arsenal of redistributive instruments in the public sector budget includes taxes and transfers, UI, pensions, health care, education and welfare services. These span a major proportion of government fiscal activity.

## 4. FEDERAL-PROVINCIAL ISSUES

In Canada, a number of these activities are among the "exclusive" legislative responsibilities of the provincial governments. These include almost all health, education and welfare services, the exceptions being UI and pensions which are federal responsibilities by explicit constitutional amendment. This means that significant sources of redistributive power are in the hands of the provinces rather than the federal government. If left to their own devices, the provinces could, if they wished, pursue their own redistributive objectives. Two important issues arise here. The first is the extent to which the responsibility for equity ought to be at the federal rather than the provincial level of government. The second is, given that at least some responsibility lies with the federal government, how can it be exercised effectively, if so many of the instruments are in the hands of the provinces? Full treatment of these subjects is beyond the scope of this paper.[20] However, it is useful for background purposes to dwell briefly on these two points.

Regarding the assignment of equity responsibility to the two levels of government, the literature on fiscal federalism tends to support the notion that the federal government ought to be primarily responsible for equity. The main argument is the view that principles of horizontal and vertical equity ought to apply nationwide. In other words, identical persons ought to be treated the same no matter where they reside. Conceptually, the social welfare function should apply nationwide. Against this grand principle must be set the counterargument that different provinces may have different "tastes" for redistribution. That is, some provinces may prefer to treat their poor more generously than others. The balance between these two arguments will determine where the ultimate responsibility for equity lies.

In Canada, the federal government assumes significant responsibility for equity and this is reflected in recent constitutional provisions. Specifically, section 36 of Schedule B of the *Constitution Act, 1982* reads:

> (1) Without altering the legislative authority of Parliament or of the provincial legislatures, or the rights of any of them with respect to the exercise of their legislative authority, Parliament and the legislatures, together with the government of Canada and the provincial governments, are committed to
>
> (a) promoting equal opportunities for the well-being of Canadians;
>
> (b) furthering economic development to reduce disparity in opportunities; and,
>
> (c) providing essential public services of reasonable quality to all Canadians.
>
> (2) Parliament and the government of Canada are committed to the principle of making equalization payments to ensure that provincial governments have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation.

The first part of this seems to suggest that minimum national standards of equity should apply, and the federal and provincial governments have joint responsibilities for achieving them. The second part obliges the federal government to make equalizing transfers to the provinces. The *Canadian Charter of Rights and Freedoms*, which was also part of the *Constitution Act, 1982*, may also impose certain equity obligations or constraints upon the government, including non-discrimination, language and mobility rights. Thus, it would seem that the federal government has significant responsibilities in the area of equity, even though it does not control all the instruments for achieving it.

There are several components of federal-provincial fiscal arrangements that are designed to allow the federal government to play a major part in setting national standards of equity. One is the ability to maintain a common base and rate structure for the individual income tax. The vehicle for this is the Tax Collection Agreement negotiated with each province except Quebec. An agreement allows the federal government to administer the income tax of the province, provided the province abides by the base and rate structure of the federal government. The efficacy of the Tax Collection Agreement mechanism depends upon the federal government maintaining a dominant position in the income tax field. This has eroded significantly over the past few years as the provincial expenditure responsibilities have grown and the federal government has turned over to the provinces more responsibilities for financing them. The recent restrictions in Established Programs Financing (EPF) transfers and the advent of the *Goods and Services Tax* will accelerate that trend to the point where the harmonized income tax system is in jeopardy.[21]

Another vehicle for federal achievement of national equity standards is the system of equalizing transfers to the provinces. The main component of this is Equalization itself. However, the other two main programs, EPF and the Canada Assistance Plan (CAP), also have equalizing aspects to them. The ultimate aim of these programs is as stated in part 2 of Section 36, which is to provide provinces with the ability to provide comparable public services at comparable tax rates. The theoretical justification for this on equity grounds relies on the notion of horizontal equity. It is fully spelled out in Economic Council of Canada (1982). Note that the equalization provision provides for provinces having the capacity to deliver comparable public services at comparable tax rates. It does not oblige them to provide identical services. That is, some provincial responsibility for equity is maintained.

Finally, the use of the federal "spending power" via conditional grants can be seen, and justified, as a means of fulfilling the federal responsibility for equity. The sorts of conditions imposed by the *Canada Health Act* can be viewed largely as equity-motivated. The same might be said of the conditions of the Canada Assistance Plan. Historically, the use of the spending power has been a matter of contention from a purely legal point of view. The provisions of the *Constitution Act, 1982* would seem to have solidified the federal government's case for using the spending power as a necessary instrument (and the only one it has) for pursuing equity in areas of provincial legislative responsibility.

## 5. IN-KIND TRANSFERS

Governments may also provide transfers of goods to persons in need rather than delivering them through the income-transfer system. These are referred to as *in-kind* transfers. Examples include food (in the United States), housing, education, health care, welfare services and transport services to those with disabilities. There are two main reasons that are used to justify in-kind transfers as opposed to cash transfers. One argument views transfers to the poor as being at least partly motivated by the collective altruism of the better off. If the rich get utility from the well-being of the poor, they will willingly agree to make transfers to them. The efficient amount of such transfers may not come about through private charity because of a free-rider problem. That is, if all the rich simultaneously benefit from donations to the poor, it will not be in the interest of them individually to donate the optimal amount; there is no incentive for each one of them to take account of the benefit generated to others from a transfer. Thus, there is a role for public provision purely on efficiency grounds. If so, the ideal form of the transfer depends upon the preferences of the rich. If the rich cared only about the level of welfare of the poor, *as judged by the poor themselves,* cash transfers would be preferable to in-kind ones. However, if the rich would prefer the poor to adopt a different expenditure pattern, that is, if they were paternalistic, the transfers might be directed to certain goods. The one difficulty that arises here is that, if the goods can be resold (as in the case of food), the two types of transfers are essentially equivalent. Of course, it is also possible to have the transfer built into the general tax-transfer system through the system of deductions and exemptions. For example, owner-occupied housing is treated preferentially in the income tax system, while food is favoured under the sales tax.

In-kind transfers may also be justified on equity grounds as part of a more general system of redistributive policy towards the poor. The argument, due initially to Nichols and Zeckhauser (1982) and recounted in Blackorby (1990), is fairly technical, but the essential point can be summarized as follows. Cash transfers are typically related to the income level of households. Yet, income levels are very imperfect indicators of individual welfare because they do not capture other characteristics, such as health, employment, leisure, etc. Thus, a given income level can include persons of differing levels of welfare, and persons of high ability can behave like those of low ability so as to be eligible for transfers. In these circumstances, if transfers could be targeted better, they could be directed toward those who truly need assistance at the expense of those who do not (but who can pose as if they do by varying their labour supply, etc.). One way of achieving this is to provide in-kind transfers in goods which are specifically related to non-income characteristics which affect utility levels. Others may include making transfers dependent upon the characteristic, and subsidizing the provision of the service in question. Different methods of targeting may be more efficient in different circumstances. Many of the above-mentioned services may be of this sort. More important for our purposes, transportation services for persons with disabilities and other disadvantaged groups would be of this sort. This will be discussed further in the next section.

It might also be noted that services provided for one group of persons may have spillover benefits for others. For example, passenger transport services to those with disabilities may benefit the able population by reducing delays which would otherwise occur from the disabled using the service. Thus, even if the main objective of providing the service is equity, efficiency considerations may support it as well.

## 6. REGULATION

Finally, governments may pursue equity objectives through the regulatory process thereby avoiding the budgetary process altogether. Examples of this include minimum wage legislation, pay and employment equity rules, and health and safety regulation both of products and the work place. The use of regulatory devices as an alternative to expenditure or tax measures will also be discussed further in the next section on equity in passenger transportation.

There is a general issue involved in regulating and providing in-kind services, and that is who ought to bear the cost. In principle, the answer to that is straightforward. The costs of any program instituted for equity purposes should be borne out of general revenues. There is no particular reason for the provider of the service to bear the cost. In practice, this may be difficult to enforce. It is not always clear precisely what the net cost of a regulation is to the sector being regulated. If the firm itself is in a regulated sector or is a public firm, it is even more difficult. Nonetheless, the principle is clear. To impose the cost on the firm is equivalent to taxing the users of the firm's services to pay for a policy whose objective is equity and which should be paid for by society at large.

# III. APPLICATION TO PASSENGER TRANSPORT SERVICES

## 1. GENERAL PRINCIPLES

The above discussion evaluated the issue of equity in general and how it might be accomplished by policymakers. It was a rather lengthy discussion concentrating on rather abstract principles. This section is intended to apply those principles to the case of passenger transportation. In fact, the application is fairly straightforward and should take relatively little space. It should, of course, be remembered that the discussion can only lay out general qualitative arguments. The exact way in which they are applied in practice must necessarily involve a value judgment.

It is useful to begin this section with a summary review of some of the principles obtained in the earlier sections. Economists naturally think of the tax-transfer process operating on the basis of income as the main fiscal instrument for redistribution. There are many instances in the literature in which supplementary instruments can improve social welfare over and above what is possible by redistributive income taxation alone. The following summarizes the types of arguments involved.

i. If the tax-transfer process is used to its optimal extent for redistributive purposes, and if persons differ in their ability to earn income, the only argument for using pricing policies, such as differential excise taxes or subsidies, for redistributive purposes is if the household utility function is not separable. In particular, goods which are relatively substitutable for leisure should be subsidized, and those which are complementary should be taxed.

ii. If there are restrictions on the use of the income tax system for redistribution, a stronger case can be made for pursuing equity through pricing policies as a "second best" equity policy. Relevant restrictions might include the following:

   a) The possibilities of tax evasion and avoidance induce virtually all countries to use a tax mix of indirect and direct taxes so as to reduce the benefits from evading and to indirectly tax those who do. If higher income persons are better able to evade, the structure of indirect taxation should be progressive.

b) If the income tax system does not treat persons with negative taxable income symmetrically to those with positive taxable income, supplementary instruments which assist low income persons can be welfare improving.

c) The government may simply lack the information to be able to implement the optimal direct tax system. On the other hand, it may have good information about the sorts of commodities that are consumed by less well-off persons and treat them favourably.

iii. If there are decreasing returns to scale industries, and if optimal taxes can be imposed, marginal cost pricing should apply (subject to the discussion of item ii above) and the losses should be recovered from general revenues.

iv. Much of the literature on redistribution treats persons as differing only in income-earning ability. However, there may be other characteristics which cause utility differentials across households. If so, redistributive instruments which are based on these other characteristics can complement the tax-transfer mechanism in the government's arsenal of redistributive devices. Furthermore, the efficiency-equity trade-off might be much different here than in the income case. If the characteristics can be observed directly, the efficiency cost of redistribution along this dimension would be limited to the cost of raising the revenues required to finance it.

v. In fact, governments use the expenditure side of the budget for purposes which have important distributional implications. Indeed, in many cases this may be their main justification. Uniform public provision of quasi-private goods through the public sector can be social-welfare improving if they have relatively greater benefits to those in the economy who are less well off. To the extent that these benefits can be earmarked to the less well off, they would be even more efficient redistributive devices. This is true even if the full potential of redistributive income taxes has been used.

The remainder of this section considers the application of these general principles to the case of passenger transportation.

## 2. ALTERNATIVE WAYS OF ADDRESSING EQUITY ISSUES IN PASSENGER TRANSPORTATION

It is useful at the outset to present a general catalogue of ways in which equity issues might be pursued in the provision of passenger transport services. This can be done via the tax system, by the use of subsidies or by regulation. A list of possible ways might include the following:

i. Preferential sales tax rates may apply on passenger transportation services. They may be restricted to certain types of transport, for example, those which are used by those less well off. A case in point is the exemption of municipal transit from the federal *Goods and Services Tax.*

ii. Related to this is the use of pricing policies on publicly owned transport, such as rail. Any price above marginal cost is essentially equivalent to an excise tax. There may be equity reasons for having differences between price and marginal cost, and there may be second best reasons as well.

iii. Passenger transport services tend to have considerable infrastructure associated with them (roads, airports, rail lines, etc.) which gives rise to overhead costs which must be covered. This makes them essentially decreasing-cost industries perhaps over sizable levels of output, since the overhead costs must be spread. The public sector may provide or finance the infrastructure. From a welfare economics point of view, this actually makes some sense as a way of enabling the industry to set prices closer to marginal rather than average costs.

iv. Special transport services might be provided on below-cost terms to the ill, the disabled and the elderly. These might include ambulances, wheelchair facilities and the like. They could be provided as part of publicly-supplied transport services, or their provision for private sector services could be subsidized or regulated.

v. Transportation facilities serving remote and disadvantaged areas could be subsidized in the sense that they could be provided despite the fact that their provision would be rejected by a conventional cost-benefit analysis using consumer and producer surpluses.

vi. Finally, there may be preferential prices given to identifiable types of persons such as the elderly, those with disabilities, etc. These could be over and above the preferential prices that might be used as a method of ordinary price discrimination. Ideally, these should be financed out of general revenues.

This may only be a partial list in the sense that there may be other ways in which public policies could serve to interfere with pure market considerations in the provision of passenger transport facilities. However, these are illustrative enough of the types of policies that are used to serve our general purposes.

Some of the above involve the provision of certain services at less than cost, and an issue naturally arises as to how such services should be financed. As a matter of general principle, the ideal would be to finance (out of general revenues) any special costs arising from fulfilment of an equity objective. This might take the form of a subsidy or of public provision itself. However, that is not always entirely feasible. It may not always be possible to identify the separate costs of special facilities for such things as disability that may have been regulated by the public sector. There are certainly many examples of cases in which regulation of standards in other contexts is not accompanied by financial compensation, such as health and safety standards, building standards and zoning regulations. An alternative which might prove feasible in some instances is to allow a generous tax deduction or credit for additional expenditures incurred to satisfy transportation regulations which were designed to satisfy an equity objective. This will help pass some of the costs onto general revenues instead of relying on cross subsidization from other users.

## 3. SUBSIDIZING PASSENGER TRANSPORT AS AN INSTRUMENT OF INCOME REDISTRIBUTION

Suppose we think of passenger transport services simply as a good purchased by households along with several other goods. The amount purchased by households depends upon their income and preferences, and the government is able to observe income for redistributive purposes. Can we make a *prima facie* case for giving passenger transport services preferential tax treatment as part of a general policy of income redistribution? As mentioned above, there are two possible reasons why one might want to supplement redistributive direct taxation with preferential treatment by commodity. The first is as follows. Redistributive taxation taxes only the real income earned from market activities; that obtained from non-market activities (that is, leisure and household production) go untaxed. If different commodities have different degrees of substitutability or complementarity for non-market activities (that is, if the utility function is not separable), a case can be made for differential commodity taxation. Unfortunately, the structure of that differential taxation is not straightforward, and involves both equity and efficiency effects. The equity effects would tend to favour lower taxes (higher subsidies) for necessities and higher taxes for luxuries.[22] The efficiency effects would tend to impose lower taxes on commodities with the non-market activities, and vice versa. Thus, for example, a necessity which is also substitutable for non-market activities would seem unambiguously to call for a subsidy. However, conflicting cases could also arise.

The demand characteristics of passenger transport services presumably vary according to mode. One might think that bus transportation has a lower income elasticity of demand than rail, followed by automobile and air. The income elasticity for the bus might also be low relative to all commodities. If so, equity arguments might favour subsidizing the bus mode. If the transport services tend to be used to commute to work rather than for leisure activities, they will also be complementary with working, in which case the efficiency effects also tend to favour subsidizing them. If these sorts of empirical arguments are held with any degree of confidence, a theoretical case could be made that, even in a world in which progressive income taxes can be employed without constraint, it might still be justifiable to subsidize forms of transport relied upon by low income persons. On the other hand, other modes of transport such as intercity transport may tend to be more substitutable for working (that is, complementary with leisure) in which case one could propose a tax on efficiency grounds. Of course, there is the further problem that the government may not have enough information to design the optimal income tax. If the government nonetheless feels confident in knowing which types of goods are necessities, it can knowingly achieve some redistribution via subsidization of particular goods.

This general argument for subsidizing some sorts of transport services might be further supported by some other subsidiary arguments. One might be the well-known second best argument, which really has to do more with efficiency than with equity. The second best argument suggests that, if a commodity is priced below its marginal cost, other commodities which are substitutable for it should be as well. In the case of passenger transport services, automobile travel is said to be priced below its social marginal cost because such things as the costs of congestion, road use and pollution are not fully included in its price.[23] Similarly, air travel may be priced below its marginal cost, if the full marginal-user cost of airports is not charged to the airlines. Since public surface transport may be to some extent substitutable for these modes, second best principles could be used to justify pricing below marginal cost.

The second argument relies on the notion that redistribution toward the poor may be partly justified by altruistic preferences of the well-to-do. If the altruism is paternalistic, it may support subsidizing particular types of goods. If transport services fell into this category, some support could be found for subsidizing them. It is not clear that the weight of this argument is particularly strong, compared with the previous two.

The above arguments considered the case for subsidizing some forms of passenger transport as a supplement to income-based tax-transfer mechanisms which could be used without restriction. If there are restrictions on the use of taxes and transfers, further support can be obtained for the subsidization of goods and services which are relatively more important to low-income persons. As mentioned above, perhaps the most important justification of having a mix of indirect and direct taxes is to counteract the massive evasion and avoidance that might arise if sole reliance were placed on direct taxes. That being so, the redistributive potential of direct taxes is not being exploited to its fullest. Under these circumstances, preferential tax treatment of necessities can be given theoretical justification. As well as food, shelter and clothing, transportation services used by lower-income persons could be given favourable treatment.

The direct tax system may, for some reason, not treat persons with negative tax liabilities symmetrically with those with positive tax liabilities. The former requires refundability of the liabilities and this may be difficult to implement fully. Also, some of the transfer mechanism is essentially in the hands of the provinces and they may not be fully coordinated with the federally-controlled income tax structure. Again, the preferential tax treatment of necessities may be a practical way of compensating for this absence of effective transfers to low-income persons.

## 4. SUBSIDIZING PASSENGER TRANSPORT AS A DECREASING COST INDUSTRY

Some types of passenger transport services may be characterized by decreasing returns to scale as a result of large fixed costs. In a perfect world, the fixed costs would be covered from general revenues in a non-distorting fashion, and the marginal cost would be imposed as a price for using the service. Capital decisions would have to be based on net surplus calculations rather than financial profitability. Any price charged above marginal cost should be regarded as equivalent to an indirect tax. The extent to which price diverges from marginal cost should be treated as equivalent to an indirect tax, and the above discussion applies. Thus, if it is desired for equity reasons to give preferential treatment to, say, passenger rail service, this service would have to be operated at a loss. In the case of buses, the recouping of fixed costs through taxes and fees of various sorts is apparently close to complete, as discussed in the Interim Report of this Royal Commission. Thus, in the absence of further indirect taxes, the practice is not far from average cost pricing, that is, above marginal cost pricing.

## 5. PASSENGER TRANSPORT SERVICES AS ASSISTANCE TO PERSONS WITH CHARACTERISTICS OTHER THAN INCOME

The above discussion concerns the incorporation of equity principles into the general tax and pricing treatment of passenger transport services. The emphasis was on redistributing among households according to income-earning ability and the possible shortcomings of the direct tax-transfer system. Now, we turn to the fact that there are other dimensions along which one may want to redistribute as well as the income dimension. It is obvious that, in practice, governments engage in many such measures. Recalling our earlier discussion, much redistribution takes place in ways other than the tax-transfer system and is based on criteria other than income. The health care system is a redistributive device based on health status; the pension system depends on age cohort; unemployment insurance depends upon employment status (and, to some extent, industry and regional location), etc. The question is whether there are certain aspects of passenger transport provision which can be viewed as contributing to equity according to non-income characteristics.

Incorporating equity considerations based on non-income factors is, in a sense, more ambiguous than those based on income. In the case of the latter, the equity concerns can be integrated into the income tax-transfer system, and the determination of the degree of progressivity can be left to those responsible for general income redistributive policy. With redistribution based on other factors, a somewhat independent judgment must be made on the extent of redistribution that is equitable. We saw earlier in our discussion of social welfare functions that, depending on the sort of judgment one makes about the degree of aversion to inequality, one can obtain very different optimal income distributions when persons differ in their utility functions. With very little aversion to utility inequality (for example, utilitarianism), income would be distributed in favour of persons who are more "efficient" at generating utility, and vice versa. For example, if persons with disabilities are assumed not to be able to convert income into utility easily, utilitarians would give them relatively few resources, that is, they would not compensate them for their disability. On the other hand, for social welfare functions with a great deal of aversion to utility inequality (for example, maxi-min), enough resources would be transferred to those with disabilities to compensate them for the difficulty of converting income into utility. This could involve substantial redistribution, especially if the efficiency costs of such transfers were low. What determines the outcome in this case is fundamentally a matter of value judgment, captured in what we have referred to as the degree of aversion to utility inequality. This makes it very difficult to state explicit policy implications since virtually any redistributive outcome can occur depending on the value judgment one makes. Even the direction of transfer of resources to persons with particular characteristics is a matter of judgment.

Furthermore, in evaluating this issue, it is not enough to know whether certain types of passenger transport services are associated with persons of certain characteristics who, for equity reasons, deserve special attention. It is also important to know if delivering the services through passenger transport is the most efficient way of doing so. If the characteristics can be identified and observed, it might be preferable to provide cash grants directly to the individuals rather than providing in-kind services. That, however, is essentially a matter of efficiency.

Potentially, there are a variety of characteristics affecting utility that might be associated with passenger transport services. In fact, a number of them have been mentioned in the Research Program for the current Royal Commission. Let us treat each in turn.

### Persons with Disabilities

Clearly one of the main disadvantages persons with disabilities face is a lack of mobility, so one would think that special provision of transport services might have a role to play here. To justify special treatment of persons with disabilities in general, it is necessary to assume that society has aversion to utility inequality. Suppose that to be the case. The assistance could take the form of cash transfers or in-kind services, or some combination of the two. There is now in place a system of cash assistance delivered to those with disabilities through the income tax. This includes a tax credit based on disability as well as the deductibility of additional medical expenses associated with the disability. One would suspect that, by any reasonable standards, the amounts involved in these two mechanisms fall far short of that which would be needed to compensate the disabled for the loss in utility due to their disability. Indeed, the implicit amount of inequality aversion contained in these measures is also probably a good deal less than that which is implicit in the system of redistribution based on differences in income-earning ability, unemployment status and illness. The tax credit as well does not distinguish among varying degrees of disability, as would presumably be required for redistribution truly based on differences in utility levels. One of the reasons for this is undoubtedly a difficulty in certifying with any degree of accuracy the relative degrees of disability of various sorts. In fact, there is apparently a good deal of uncertainty surrounding the exact criteria for eligibility for the Disability Tax Credit. Furthermore, the affording of deductibility for additional medical expenses represents only a limited attempt to compensate for the loss in utility due to disability. At the least, one might have expected full compensation to have been given for this, rather than the partial compensation implied by the tax savings from deductibility. At most, deductibility reflects the additional cost of earning income implied by the medical expenses.

In addition to the above forms of cash assistance, those with disabilities also obtain some services in kind. To the extent that their medical costs are insurable, these are provided free of charge.[24] Again, this compensates for many of the necessary medical expenses that are incurred as a result of being disabled, but does not attempt to compensate for the utility-reducing effects of the disability itself (for example, pain and suffering, etc.). That is presumably the role of cash transfers. There are certain welfare services that provinces supply to the disabled that are analogous to full health insurance. Like health insurance, they represent transfers which are directly related to the extent of the disability. Persons who are more disabled, in the sense of requiring more medical and welfare services, receive correspondingly more assistance. This would seem to be an efficient way of differentiating among persons with differing degrees of disability.

The provision of transportation services to the disabled, including such things as wheelchair buses, special services at rail, air and bus terminals, specially designed seats, washroom facilities, etc., are directly analogous to in-kind medical and welfare services. They are a form of social insurance whose benefits are related to the degree of particular forms of disability. On equity grounds, it would seem to me to be arguable that these services should be freely provided to users for two reasons. First, that would put them on an equal footing with medical insurance, which itself must reflect an equity judgment. Second, from a value judgment point of view, it would seem to me to reflect a minimum level of aversion to utility inequality comparable to what seems to be accepted in the income tax-transfer system. As mentioned, there is an issue as to how these should be paid for. We have suggested that, in principle, the cost should be borne out of general revenues. This could take the form of a subsidy to the provider, in the case in which the provider is a private operator, though that may be cumbersome to administer. Perhaps the more sensible procedure would be to use a tax credit system for at least part of the costs involved in making the services available.

### The Poor

The case for providing transportation services to the poor is quite different from that of the disabled, if by poor we mean those with low income. Of course, poor persons may be poor because of disabilities or, as discussed below, because of lack of employment opportunities in the province of residence. If so, the disability should be thought of as the cause. However, in general, we can think of poverty *per se* as reflecting differences in the ability to earn income rather than differences in the ability to transform income into utility. That being the case, transport services are merely one of the many types of goods that the poor consume along with a variety of others such as food, housing, clothing, etc. Thus, as discussed above, policies for equitable treatment of these persons is primarily addressed through the tax-transfer system.

The case for providing in-kind transfers rests largely on an argument that passenger transport services are substitutable for non-market activities. It is not clear to me that such an argument can be sustained. Of course, if we have in place a large indirect tax system as well as a direct one, an argument can be made for incorporating equity norms into the tax structure. In this case, it can be held that services used relatively more heavily by low income persons should be given preferential tax treatment. This was discussed in more detail above so need not be repeated here.

### Residents of Remote Areas

Residents of remote areas obviously seem to have greater need for transport services than other persons to obtain the same level of utility. Relatively large amounts of their budgets would be devoted to this as compared with other persons. Thus, it seems natural, at first sight, to think of providing such services at reduced cost. In judging this issue, a couple of considerations seem to be relevant. First, it is important to know whether the fact of residency in a remote area should be treated as an exogenously given characteristic of a person, or one which can be acquired at low cost. To say the same thing in other terms, one wants to know the extent to which the costs of moving from remote areas, *including* psychic costs, are high or low. If they are high, say because of cultural attachment to place of birth, then residency in a remote area might be treated as a non-income characteristic which directly affects utility. It then becomes a matter of comparing utility levels of persons who are resident in remote areas with other persons who are resident in populated areas.[25] If it is judged that residency in a remote area itself is a characteristic which causes utility to be lower, then a case could be made for compensating for that difference, assuming that one is averse to inequality differences. However, that compensation might well take the form of cash transfers, say, delivered as tax credits, rather than transfers in kind. In this case, the cash transfer need only be related to the fact of residency in remote areas and not other characteristics.

On the other hand, transfers in kind might be justified, if the degree of utility loss from living in remote areas was related to the level of consumption of particular services by persons. For example, the disutility of living in remote areas might be related to the quantity of transport services consumed. Those with the greatest disutility might travel to and from the area most often, thereby incurring greater costs than others. It would not likely be feasible to make cash transfers to households based on their demand for travel services, since it would be difficult to measure the latter for any given individual. In these circumstances, targeting assistance to persons through subsidized transport services might be an efficient way of pursuing redistributive equity goals.

It might be noted that, if costs of migration to remote areas were not prohibitive, complications would arise. Residents of remote regions would contain a mix of persons who were there by birth, and who preferred to be there, and those who were born elsewhere and migrated there. The latter presumably require some financial compensation to overcome the psychic cost of moving to the remote region. In this case, the real income they obtain will differ systematically from their observed income, and this ought to be taken into account in the income tax-transfer system. In particular, the tax-transfer system based on observed income would systematically discriminate against moving to the remote region, since the differential income compensating for the psychic cost would be taxed. Thus, an inefficiently low amount of migration to the remote area would occur. The remedy for this would seem to be to provide preferential treatment through the income tax system rather than through in-kind services.

On the other hand, if mobility costs were low so that persons were free to move to and from remote regions, they would do so until they were in the region offering the greatest income. In this case, there would seem to be no apparent reason to differentiate through the income tax system between persons residing in different areas. In this case, whether in-kind services should be given special treatment would rely on the same general arguments as stated earlier about supplementing the income tax system with differentiated sales taxes. If transport services for persons in remote areas were substitutable for non-market activities, a case could be made for providing them at preferential cost. Also, in the indirect tax component of the tax system, if transport services were necessity goods to persons in remote areas, a case could be made for giving them preferential tax treatment in the sales tax system.

### Residents of Have-Not Provinces

The case of residents in have-not provinces is somewhat similar to the case of persons in remote areas, though with some exceptions. The exception concerns the fact that the one important thing which differentiates persons in different provinces is the behaviour of their respective provincial governments. It has been well established that, in a decentralized federation where the provinces have significant taxing and spending responsibilities, there is an economic argument that can be made on both equity and efficiency grounds for a system of equalizing transfers.[26] The objective of such equalization is captured in the wording of subsection 36(2) of the *Constitution Act, 1982* which obliges the federal government to make equalizing transfers to the have-not provinces such that all provinces can provide comparable public services at comparable rates of taxation. This objective is realized in Canada by a variety of instruments including Equalization, Established Programs Financing and the Canada Assistance Plan. Equalization in principle works to compensate for differences in tax capacity among provinces.

The relevance of this provision for passenger transport depends upon, first, the extent to which passenger transport services are regarded as public services, and, second, on the extent to which they are regarded as the responsibility of the provinces. If they are regarded as public services, it will presumably be because of the sorts of equity reasons discussed above. To the extent that the provinces are responsible for their provision (for example, municipal transit, buses, roads, etc.), the federal government may, nonetheless, have an interest in setting equity standards, since by subsection 36(1) it bears joint responsibility for equity. In that case, the federal government can only exercise its influence over passenger transport by less direct means. For example, it may provide incentives through the tax system, or it may provide conditional transfers to the provinces to maintain some sorts of national standards. It cannot legislate directly in areas of provincial responsibility, and presumably this implies that it is unable to regulate standards. A full consideration of federal-provincial fiscal arrangements as they apply to passenger transport is beyond our scope. However, the ultimate equity objectives that the federal government might want to impose are the same as those we have already discussed.

### The Elderly

Finally, let us consider one further category of persons not explicitly mentioned as disadvantaged, but nevertheless one that could be treated as such, and that is the elderly. This may be relevant since the elderly may have special reasons to rely on certain types of transport services. The case of the elderly is essentially the same as that of the disabled in terms of the principle involved.[27] Being elderly is a characteristic which is observable and which affects one's utility over and above that due to income level. One might want, therefore, to make cash transfers contingent on age for equity reasons. Also, to the extent that utility varies with need for transport services, provision of such services can be justified on equity grounds.

## IV. SUMMARY REMARKS

The purpose of this paper has been to survey the arguments for using equity as a criterion for public policy; to discuss the ways in which equity considerations are incorporated into policy, including through direct and indirect taxes and transfers, social insurance, government expenditures, transfers in kind and regulation; and to consider what implications this might have for passenger transportation services. Some of the key results we have discussed are as follows:

- Public policy choices necessarily involve making value judgments. It is convenient to think conceptually of these judgments as being incorporated in a social welfare function, which is an aggregate of individual utilities. A key value judgment involved in this aggregation is the degree of aversion to inequality in utilities. Depending on one's aversion to inequality, very different redistributive policies can be obtained, from the progressive to the regressive.
- Individual utilities depend upon a number of factors, including ability to earn income, effort, and other characteristics such as health status and disability, age, employment and location of residence, to name a few. Redistributive policies can be directed at any of these dimensions.
- The conventional income-based tax-transfer system addresses mainly inequalities aimed at differences in ability to earn income. There is a limit to its redistributive potential, both because there are other sources

of utility than ability-to-earn-income differentials, and because income derives not only from ability to earn, but also from effort. In other words, there is an efficiency-equity trade-off. Studies have indicated that there are strict limits to the redistributive potential of income-based taxes and transfers.

- Governments engage in a number of other redistributive policies besides those based on income, and some of them are delivered through the income tax system. In fact, a significant proportion of program spending is actually motivated mainly by redistributive considerations, including such large programs as UI, pensions, medical care, welfare, and even public education. Many of them tend to be directed to characteristics other than income. In other cases, public provision of quasi-private goods can serve an income redistributive goal, if they are of relatively greater benefit to low-income persons.
- On the tax side, governments rely both on direct and indirect taxes to raise the bulk of their revenues even though, in principle, it might be better to rely on direct taxes only. Indirect taxes become necessary to reduce the ability and incentive to evade direct taxes. A case can be made for incorporating some progressivity into the indirect tax system.
- Applying these principles to the case of passenger transport, introducing equity considerations into the provision of passenger transport can be viewed as supplementing the income-based tax-transfer system, or as addressing utility differences arising from characteristics other than ability to earn income.
- As an instrument for income redistribution, subsidizing some forms of passenger transportation can be justified to incorporate equity into the indirect tax system. This would presumably apply to forms of transport which are used mainly by low-income persons. There are a variety of reasons discussed in the text as to why equity considerations ought to be incorporated into the indirect tax system.
- Subsidizing passenger transport could also be justified on grounds of efficiency. For one, these may be decreasing cost industries which would be operated at a loss under optimal pricing policies. For another, the second best argument states that, if some forms of transport are available below marginal social cost (for example, road transport), then others should be as well.

- Subsidizing of particular forms of passenger transport services can also be justified to provide assistance to persons on the basis of utility characteristics other than ability to earn income. This is particularly true of the elderly, the disabled and the ill of health, and it may apply to a certain extent to those in remote areas.

In summary, there are good theoretical reasons for taking equity considerations into account in the provision of passenger transportation. However, to do so requires that value judgments be made. It also requires some confidence in the relationship of various forms of passenger transport to individual characteristics which affect utility.

## APPENDIX

The purpose of this Appendix is to discuss certain aspects of the literature on social choice and social welfare functions which have a bearing on the meaning and use of equity in evaluating public policy. The starting point is the Arrow Possibility Theorem which was mentioned in the text. Recall that it states that, if the only information we have available is the rankings of alternatives by the persons in the economy, if there are no restrictions on the form of those rankings, and, if both the Pareto principle and the independence of irrelevant alternatives must be satisfied, then majority voting procedures cannot be guaranteed to give a rational ranking of the alternatives.

In response to this Arrow Possibility Theorem, two branches of literature developed. One branch, known as *positive social choice*, is concerned with relaxing some of the technical requirements, such as the independence of irrelevant alternatives or the unlimited nature of household rankings, so as to avoid the dictatorial outcome. This literature is preoccupied with the mechanism of obtaining social rankings rather than the normative properties of the rankings, so is of little interest to us. The more interesting branch for our purposes is known as *normative social choice* analysis and looks at the consequences of using more information on household preferences. We restrict attention to that.

Under the Arrow Possibility Theorem, only household rankings or orderings of alternative allocations are allowed. Normative social choice theory considers adding, to that, information concerning the measurability and comparability of individual utilities. Naturally, this involves making value judgments over and above those of individualism and the Pareto principle. The literature on normative social choice is much too long and complex for us to begin to survey. However, there is one notion that has come out of it that is very appealing for our purposes, and that is the following. Suppose we accept some notion of measurability and interpersonal comparability of household utilities. Sen (1977) has shown that, under very weak requirements, the social ranking of alternative social states depends only upon household utility levels achieved in those states, and not upon any extraneous information. The requirements are unrestricted domain, the Pareto indifference principle, and the independence of irrelevant alternatives. In the literature, this is referred to as the principle of *welfarism*. In other words, the abstract construct of a Bergson-Samuelson social welfare function can be used as a conceptual device for ranking social alternatives.

We take this notion of a social welfare function which depends only upon individual utilities as our starting point. Making it operational involves two further steps. One is devising ways of measuring individual utilities in, say, dollar terms. The other involves weighting these utility measures in the social welfare function. The latter naturally involves a value judgment. Let us discuss these very briefly in turn.

The conventional means for measuring the utility of a household is by the use of a so-called "money metric" indicator of utility. Technically speaking, a money metric associated with a given level of utility is the amount of money that would be required to achieve that utility level at a given set of reference prices for all goods (including leisure). This is what economists refer to as the *expenditure function*. Differences in the value of the expenditure function between two different allocations can be interpreted as the compensating variation or the equivalent variation depending on what set of reference prices is used. The conventional consumer surplus notion is simply an approximate measure of the compensating or equivalent variation. The fact that the value of the money metric depends upon the set of reference prices used is simply a reflection of the fact that utility cannot be unambiguously measured. It is useful to refer to this money metric indicator as the *real income* of households. If all persons had a common utility function, and if the same set of reference prices were used by all, the social welfare function could be rewritten as a function of these measures of real income rather than of utility levels. We return below to the form that the social welfare function might take.

Real income as measured above is a sensible money metric measure for utility if persons have the same utility function; that is, if they have the same ability to convert real income into utility. However, there are some obvious circumstances in which that will not be possible. Two that have been considered in the literature are as follows:

### Differences in Household Size and Characteristics

When households consist of differing numbers of persons of different ages, they are likely also to differ in the utility they generate from a given level of per person real income. For example, some consumption goods are consumed in common among members of the household so that economies of scale can be achieved in consumption. Furthermore, some economies in household production of non-market services can be obtained. Economists have attempted to deal with these differences by adjusting real incomes by means of *household equivalence scales*. The household equivalence scale is constructed in the following manner. First, a reference household is chosen, for example, a single person with no children. Then, the equivalence scale for a person in a household of type *x* is calculated to be the ratio of the real income of that person to the real income that would be required by a person in the reference household to obtain the same level of utility. In other words, the equivalence scale can be interpreted as the number of persons in households of type *x* that are equivalent to one person in the reference household in terms of the ability to generate utility from real income. Equivalent real income is simply observed real income deflated by this equivalence scale. The concept of equivalence scales is widely used in empirical work for dealing with families of different size and composition. It could also be used to adjust real incomes to account for a variety of other circumstances, such as differences in the cost of earning income, medical expenditures, moving expenses, and the extra costs of living in remote areas.

It should be also noted that the concept of household equivalence scales bears a close resemblance to the principle of *horizontal equity* in tax theory. The latter says that persons at the same level of utility ought to be treated the same by the tax system (that is, ought to pay the same taxes). This idea is captured by the saying that "equals should be treated equally." The implementation of horizontal equity should, in principle, be accomplished through the tax base. That is, the tax base should be adjusted by a system of deductions so that persons with equal utilities have the same tax base, even though they have very different pre-tax incomes. The tax-rate structure can then be applied to the adjusted base. This procedure is generally used by economists as an argument for deductions rather than credits to account for such things as family size, medical expenditures, educational expenditures and the cost of earning income.

### Differences in Utility Functions

A related problem is that of the case in which different persons with the same income receive different levels of utility from that income. For example, persons with disabilities or ill health may require more income to generate the same amount of utility. This is a more difficult one to deal with since there are obvious identification and measurement problems in correcting for these differences in utility functions. To correct for it fully in the tax system would presumably involve more than a set of deductions. Whether one actually wants to correct for it fully is discussed further below.

There are other ways in which utility functions may differ among individuals as well. For example, persons may have different preferences for particular types of goods. Thus, some persons may have a relative preference for leisure, others for fast cars, others for taking risks, etc. These differences would also be very difficult to take full account of because of obvious measurement problems. On the other hand, from the point of view of redistributive equity, it is not obvious that they are essential problems.

Suppose we have solved these problems of how to measure utility using some notion of real income suitably corrected for differences in household circumstances and utility functions. The next step in principle is devising a weighting system for aggregating these utility measures, or, in other words, devising a social welfare function. This is where the crucial value judgments arise. Depending upon the type of social welfare function chosen, very different redistributive policies can emerge as is shown in the text. If we are prepared to make further value judgments, a simple general form of social welfare function emerges which allows us to isolate a key determinant of redistributive equity.

To begin with, let us postulate some reasonable properties that a social welfare function might be required to satisfy. It will be assumed to satisfy the Pareto principle and to be welfaristic (that is, to depend only on utility levels of households, and to be increasing in individual utility levels). Following much of the literature, the social welfare function will be assumed to satisfy the following further reasonable technical properties: anonymity, separability and quasi-concavity. Anonymity means that it does not matter which households get which utility levels; only the utility levels themselves count. Separability means that, in ranking two allocations, only those households which have strict preferences over the two should count, not those which are indifferent. (This was due to Fleming (1952) who used it as a basis for arguing in favour of a utilitarian social welfare function.) Quasi-concavity is a technical term which is equivalent to saying that social indifference curves in utility space cannot be concave to the origin. These requirements leave a large family of social welfare functions. However, they differ from one another in what may be termed their *aversion to inequality*. The notion of aversion to inequality is illustrated in the text for the simple two-person case. Here we may simply note the general algebraic form that the social welfare function may take:

$$W = \sum_{h=1}^{H} \frac{(u_h)^{1-\rho}}{1-\rho}$$

- where $u_h$ is the real income of household $h$, $H$ is the number of households, and $\rho$ is the aversion to inequality, sometimes also referred to as the equity parameter. Note that for $\rho=0$, we have the classical utilitarian case considered in the text. Similarly, as $\rho$ approaches infinity, the social welfare function approaches the maxi-min form, also discussed in the text. More generally, the higher the value of $\rho$, the greater the aversion to inequality in utilities among households, and the stronger the equity-efficiency trade-off.

The consequences of differences in the degree of inequality aversion for redistributive policy are illustrated in the text with reference to lump-sum redistributive transfers when total incomes are fixed. However, there are other circumstances in which the parameter becomes important as well. Two further cases will illustrate this. The first case is that in which we allow labour to be variable, but retain the assumption that income can be redistributed in a non-distorting way. The second occurs when we allow for the efficiency costs of redistributive policy.

Suppose we continue the above two-person example, but assume that the persons have the same utility function. Furthermore, assume that they have different wage rates because of some underlying differences in ability, and that they can vary their income by changing their supplies of labour. Thus, utility is assumed to depend upon consumption (after-tax income) and leisure. *A* is assumed to be the high-wage person and *B* the low-wage person. For this case, the government is assumed to be able to redistribute income in a lump-sum way, and we ask how redistributive the tax system should be. Consider the two extremes of utilitarianism and maxi-min.

In the utilitarian case, the government redistributes income until the marginal utility of consumption is the same for both persons. As Stiglitz (1987) has shown, equalizing the marginal utility of income entails a highly redistributive policy which actually makes the high-wage person worse off than the low-wage person. In the special case in which the utility function is the sum of the utility of consumption and the utility of leisure, full equality of income is achieved, but high-wage persons work more because of their higher wage rate.

The maxi-min case has been considered by Sadka (1976). Here, utility levels are equalized by the tax. Since the high-income persons will be supplying more labour, they will have to be left with high levels of income to keep them at the same utility level as the low-wage persons. Consequently, the tax system will be less progressive than under utilitarianism. In fact, there is no presumption that it will be progressive at all. Depending on the shape of utility functions (that is, the substitutability of leisure for consumption), the tax could be regressive or progressive.

Thus, even without bringing efficiency considerations into the picture, there is considerable ambiguity about how redistributive the tax system should be. It depends upon whether or not utility functions differ; whether leisure is variable and, if so, how substitutable it is for consumption; and how much inequality aversion there is in the social welfare function.

Once efficiency considerations are added, the analysis becomes more complicated, but the ambiguities remain. The complications arise because of the fact that redistributive taxation is no longer lump-sum, but is based on income. That being the case, the tax imposes a distortion on labour supply, and the distortion increases with the extent of redistribution. There is thus a trade-off between equity and efficiency. Unfortunately, the analysis of this problem is very complicated, and most authors have had to resort to simulation techniques. There is an enormous literature on the so-called "optimal income tax" which calculates the form of the income tax schedule under a variety of supposedly realistic assumptions about individual preferences and social welfare functions. Basically, the message of that literature is that the optimal amount of progressivity of the income tax is surprisingly limited.[28] It is not clear from the literature how much of that is due to the efficiency-equity trade-off and how much is due to the variability of leisure *per se*.

## ENDNOTES

1. See, for example, Sen, 1970.

2. A more technical and detailed review of these arguments can be found in Blackorby and Donaldson, 1990.

3. A full discussion of this issue may be found in Boadway and Bruce, 1984.

4. The former arises because some changes may involve redistribution with no change in efficiency. The hypothetical compensation test will be satisfied only if all persons could be made potentially better off by a change. If a policy has mainly redistributive effects, that will not be possible. For example, to use the technical jargon of welfare economics, a policy change which involved a move along the society's *utility possibility frontier*, making one group of persons better off and another worse off without distorting the economy, could not be ranked by a hypothetical compensation test. The test would not be satisfied either for the policy change or for the change in the opposite direction. The possibility that the compensation test is contradictory in the sense that it could be satisfied in both directions is well known and is referred to as the Scitovsky Paradox after Scitovsky, 1941. It is discussed fully in Boadway and Bruce, 1984.

5. One of the main advocates of this has been Harberger, 1971.

6. This is sometimes referred to as a Bergson-Samuelson social welfare function after Bergson, 1938 and Samuelson, 1947.

7. This social welfare function goes back to Mill, 1921 and is sometimes referred to as classical or additive utilitarianism.

8. This is sometimes referred to as the *Rawlsian* social welfare function after Rawls, 1971.

9. This is the classic case of Edgeworth, 1881.

10. See Mirrlees, 1971, Roberts, 1984 and Tuomala, 1990. Taking occupational choice into account, it is even more limited. In fact, rather perverse redistributive results can be achieved in this case, as has been shown in Boadway, Marchand and Pestieau, 1990.

11. For a detailed discussion of the role of the corporate tax, see Boadway, Bruce and Mintz, 1987. There are, of course, those who see the corporate tax as a vehicle for taxing the rich and would like to see more revenues extracted from the corporate sector. They would do

this through the corporate tax itself as well as through such things as minimum taxes levied on corporations. It is not clear that thinking of the corporate tax as a redistributive tax makes much sense. For one thing, it would be a very blunt instrument for the purpose. For another, it has become widely accepted that, given the degree of openness of international capital markets and the ease with which corporate capital can be reallocated among countries, much of the incidence of the corporate tax falls back on non-capital factors of production, especially labour.

12. In fact, many of these are now delivered through credits rather than deductions, though credits can be structured to have similar effects to deductions when combined with rate structure changes. We would argue that, where it is appropriate to make adjustments in the tax through the base, this should be done by deductions (exemptions) rather than credits.

13. Most incidence studies have shown that the tax structure as a whole is not too different from proportionality. See the recent survey of the literature in Whalley, 1984.

14. The choice of a destination or an origin basis would be irrelevant for this equivalence.

15. Technically, a separable utility function may be written

$$U = U\,[f(X_1, X_2, \ldots, X_n), L]$$

where $X_i$ is the consumption of good $i$ and $L$ is leisure. The implication of this function is that relative demand for the goods is independent of the amount of leisure taken.

16. On theoretical grounds, the only source of market failure that has been identified as a potential argument for government intervention is the existence of search externalities (Diamond, 1981). This could hardly form a justification for the structure of UI as we see it today.

17. See Browning, 1975.

18. See Gordon and Varian, 1988.

19. The result seems first to have been discovered by Nichols and Zeckhauser, 1982. A cursory summary of this literature is found in Blackorby, 1990. The application to health services is in Blackorby and Donaldson, 1988; and that to education and pensions is in Boadway and Marchand, 1990. Guesnerie and Roberts, 1987 had applied a similar analysis to the case of minimum wages as a way of inducing more leisure. The analysis has been extended to unemployment insurance by Marceau and Boadway, 1991.

20. I have tried to deal more fully with these issues in Boadway, 1991.

21. This argument is developed in Boadway, 1989.

22. By necessities, we mean commodities which comprise a lower proportion of expenditures of a person's income as income rises. Conversely, luxuries are a higher proportion of expenditures as income rises.

23. This may be only partly true since the cost of fuel may be above its marginal cost due to taxes.

24. That is, they are free of charge at the margin. Medical plans may require premiums to be paid, but these do not vary with treatment.

25. It is also the case that persons in remote areas are better off than if they had to move to populated areas. However, that is not the issue here.

26. See Economic Council of Canada, 1982.

27. That is not altogether true. Being elderly is a part of the life cycle that everyone has a possibility of encountering. Some persons fare better than others in terms of well-being when elderly.

28. A good survey of the literature may be found in Tuomala, 1990.

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## 4

# TRANSPORTATION AND ECONOMIC DEVELOPMENT: A SURVEY OF THE LITERATURE

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## OVERVIEW

This paper is both a survey of the literature on transportation and economic development, and an essay that addresses many of the questions that are of interest to the Royal Commission on National Passenger Transportation. This paper is referred to in the text as "the survey," and it deals with the following:

- transportation and economic development in general, and as it concerns passenger transportation in particular;
- transportation and regional economic development in general, and as it concerns passenger transportation in particular; and
- transportation and tourism.

After introductory and methodology comments, these areas are developed in Parts A, B and C. An extensive bibliography is included, and is referred to throughout the paper.

## THE CHALLENGE

Economic development is defined both narrowly and broadly. Narrowly, the concern is with the growth of real Gross Domestic Product (GDP), real GDP per capita, and real GDP per worker. Broadly, the following indicators are considered: GDP and some distributive measures; GDP and non-market economic activities; GDP adjusted for changes in resource stocks, indicators of social well-being and environmental quality.

The overarching set of questions are:

Has transportation caused economic development? Have identifiable transportation elements, individually or in concert with other elements, caused identifiable changes in Canadian measures of economic development? More specifically, have passenger transportation changes caused economic development?

As Maddison (1989) has shown, Canada, along with other Western industrialized economies, has gone through four phases of economic growth during the 20th century. These are:

- fairly rapid economic development before World War I;
- slow growth, stagnation and depression from the end of World War I through 1950 (for Canada and the United States, the results of the Great Depression were reversed, and considerable increases in economic activity took place during World War II);
- a so-called "Golden Era" of exceptionally rapid economic development from 1950 through the early 1970s (with considerable convergence of national productivities toward the leader, the United States); and
- slow growth and higher inflation between the mid-1970s and the end of the 1980s.

Was transportation a contributing cause of these phases of economic development? Is there anything in a recent argument that the slowdown in investment in infrastructure (particularly in transportation) since the early 1970s has been a significant factor in the recent general economic slowdown?

Also, is there anything in the contention that deficiencies in infrastructure, including transportation facilities, are a major drag on the growth prospects of the 1990s? (Munnell (ed.), 1990.)

These questions may be asked on a less macro basis. For example, have broad *sub-groups* of transportation investment, operation and regulation caused identifiable outcomes for important *segments* or *regions* of economic development? Do these sub-groups of changes add up to important changes in both the size and structure of the Canadian economy? Some illustrative questions follow:

- Has the construction and operation of the Interstate Highway System in the United States and the equivalent system in Canada since 1950 been a major contributor to national productivity in these countries?
- Historians (Bothwell et al., 1989) have recorded that the widespread use of privately owned and operated cars in Canada occurred after World War II. Was this a factor in Canada's post-war Golden Era of economic development? (*Historical Atlas of Canada*, Vol. III, Plate 53)
- Have containers and piggy-back services substantially improved medium- to long-distance transportation of medium-weight, medium-value goods over long distances, and thus contributed to growth of markets, division of labour and productivity of important economic sectors?
- Has the development of efficient medium- to long-distance jet passenger aircraft revolutionized middle- to long-distance passenger travel? Have these changes greatly improved business travel and thus made possible the efficient management of larger national and international businesses, and thus improved productivity in many sectors of the economy? (*Historical Atlas of Canada*, Vol. III, Plates 53, 54 and 55)
- Have the United States and Canada achieved efficient highway pricing and investment as well as efficient airport pricing and investment? If not, what have been the costs of the inefficiencies? What can be done about them?
- Have the regulation and deregulation of rail and trucking services reduced the inefficiencies in these services, and thus greatly improved the productivity in some sectors of the Canadian economy?

- What are the alternatives in financing mixed private-public goods such as transportation, and in particular passenger transportation? What has been used in Canada? Are the approaches efficient and equitable?

The analysis can also be carried on at a much more micro level. Have particular projects in transportation been clear successes or failures? What are the criteria for decision making and evaluation? Are they appropriate or inappropriate? Are there major gaps in the available information, so that decision making and evaluation of transportation projects are clouded with uncertainties? What are the precise linkages of transportation projects or decisions and specific economic outcomes? How has the transportation system, its use and regulation adapted to changes in technology, demands for services, and other economic circumstances?

## THE LITERATURE THAT PROVIDES EVIDENCE ON TRANSPORTATION AND ECONOMIC DEVELOPMENT

A wide variety of materials should be considered, some of them cursorily. They include:

- theories of international and inter-regional trade, and of location of firms and industries;
- theories of economic development, particularly regarding capital, knowledge and the extent of markets;
- theories of public goods and public choice, and impressionistic application to transportation; issues of externalities;
- comparative economic history:
  - general literary economic history; metropolis literature;
  - quantitative economic history, particularly that which treats economic development, transportation, trade and movements of people;
  - history and analyses of shifting structures and location of economic activities; and
  - transportation history;
- economic geography, particularly that which deals with changing location and interrelationships of economic activities and people;

- empirical analyses of general macroeconomic development;
- empirical analyses of models of transportation and economic development: macro, segments, regions, also demand for and cost of analyses of transportation services, particularly of passenger services;
- decision making on capital projects, particularly on infrastructure, and, within this category, especially on transportation;
- policy literature on economic development: general, regional, and regional disparities;
- policy literature on transportation; and
- regulation, deregulation, nationalization, privatization, subsidization and taxation of transportation.

## THEMES IN THE LITERATURE

One central theme is that investing in transportation has contributed to economic development. The improvements to railroads and ships after 1870, trucking in the 20th century, and the Interstate Highway System after World War II illustrate this theme.

Transportation elements are one set out of many sets of contributors to economic development. Others include saving and the accumulation of capital; improvements in knowledge and innovations; increases in the size of the labour force and improvement in its skills; and changes in trading environments.

The contributions of transportation to economic development are difficult to identify, for several reasons. To be precise about the causality, and the strength and efficiency of the contributions, is a demanding task, fraught with uncertainty.

When many factors are causes of economic development, individually and in concert, untangling the contributors is difficult. This is so whether the elements be the size and skills of the labour force, the size and structure of the stock of capital, the state of knowledge, or the trading environment, to name a few.

Transportation decisions are often made on a case-by-case basis, yet their effects often accrue on a network basis. Thus, the consequences of transportation decisions may be quite different (sometimes better and sometimes worse) than were envisioned in the initial decision.

Transportation elements are sometimes causes of economic developments, and sometimes consequences of them. The developments of cars, highways and air services have caused changes in passenger transportation. However, the increases in wealth and income of people, from whatever sources, have caused increased travel. Analyses that can cope with and measure two-way causality are notoriously difficult.

The measurement of costs and benefits of activities carried out through market economies can be made within tolerable margins of error. But the measurement of costs and benefits of government activities is more complex and subjective. Even more treacherous is the measurement of costs and benefits of saving time, reducing noise, increasing safety, restructuring logistical arrangements, and protecting the environment.

Despite the difficulties of identifying and measuring the costs and benefits of transportation elements for economic development, the effort must be made. The attempt can be carried out at a highly macro level (all transportation investment and the national output of goods and services), at intermediate macro levels (blocks of transportation and segments and regions of a nation), and at micro levels (the evaluation of particular transportation projects). Indeed, the literature to be surveyed covers all these approaches.

## GEOGRAPHIC DISTRIBUTION AND MOVEMENT OF PEOPLE

Economic development generates geographical distributions of activities and people that are uneven and specialized. Geographical distribution is partly a reflection of transportation services, but is largely determined by other factors. Except for resource industries, strong tendencies have emerged throughout the world in this century for activities to be concentrated in metropolitan areas. (See Careless, 1979; Kerr, Holdsworth and Matthews, 1990; *Historical Atlas of Canada*, Vol. III; McCann, 1987.) As cities tend to differ in the types of services and commodities they produce, inter-regional movement of goods and people is necessary in a developed economy.

Transportation of people is an integral part of the growth and operation of developed economies. Much of the movement is intra- rather than inter-regional: going to and from work, shopping, attending school, obtaining health care, enjoying day-to-day recreation. Private cars and small trucks, taxis and public urban transportation are the main sources of local transportation.

Inter-regional movements of people are the main focus of the Royal Commission. As shown in its Interim Report, private recreational and vacation travel are the largest portion. Private cars are the dominant mode for short-to-medium distances, and air services for medium and longer distances. Buses and trains are now the minority modes for such travel. Inter-regional business travel, typically by air, is also substantial.

For movements of people, cars, trucks and buses are joint users of the road systems. Joint use of airports for goods and people movement is also important.

Developments in *passenger transportation* have been factors contributing to economic development. These include, for example, the increase in ownership and use of passenger automobiles in the 20th century, and post-World War II development of large, jet-engined passenger aircraft. However, just as for goods, and for the same reasons, the precise links between passenger transport and economic development are more difficult to determine. Transportation causing economic development — and the obverse, economic development causing transportation — are important characteristics of movements of people.

## CONTENTIOUS ANALYTICAL AND POLICY VIEWS

Inevitably, there are considerable imprecisions about policy regarding transportation, reflecting:

- difficulties in determining cause-and-effect relationships between elements of transportation and economic development;
- differences of view about transportation services as public goods;
- difficulties in measuring costs and benefits, as noted already;
- the domain being considered — country, state or province, region, or municipality;

- different views about the feasibility of imposing and collecting charges for use of public facilities;
- differences of market conditions;
- differences in values or objectives of economic and social policy; and
- differences of view about the efficiency of government.

From even a preliminary review of the literature, some contentious analytical and policy views emerge:

- the United States and Canada have some transportation facilities and services that fall short of current technology, demands, and cost opportunities;
- even when facilities are appropriate, they are used inefficiently;
- counting of the benefits and costs of transportation is inappropriate;
- the nation has too much, or too little infrastructure, particularly transportation infrastructure;
- decision-making models for transportation are grossly wrong;
- efficient transportation services are impeded by massive monopoly practices, "feather-bedding," subsidization, regulation, and bureaucratization; and
- efficiency considerations in transportation are overwhelmed by considerations of entrenched special interests, distributional pressures and political values (see the debates between Winston, 1990 and Altshuler, 1990 in Munnell (ed.), 1990).

# THE SURVEY

## PART A — TRANSPORTATION AND ECONOMIC DEVELOPMENT

### THE STATISTICAL RECORD OF ECONOMIC DEVELOPMENT

Maddison provides the most thorough and up-to-date analysis in his study, *The World Economy in the 20th Century* (1989). What follows are a few extracts from that book.

Table 1 is a summary of the aggregate of the 16 Organisation for Economic Co-operation and Development (OECD) countries and some components, 1900–87. It shows that per capita real incomes among the OECD countries were over five times as large late in the 20th century as at its beginning. It also shows that about two thirds of the increase in real product was from increases in output per capita.

*Table 1*
SUMMARY OF THE AGGREGATE OF THE 16 OECD COUNTRIES AND SOME COMPONENTS — 1900–1987

| | | |
|---|---|---|
| (a) GDP in billion "international" dollars at 1980 prices | 1900 | 603.1 |
| | 1987 | 7,759.3 |
| (b) Population (million persons at mid-year) | 1900 | 310.0 |
| | 1987 | 700.7 |
| (c) Per capita GDP in "international" dollars at 1980 prices | 1900 | 1,946.0 |
| | 1987 | 11,073.0 |
| (d) Rate of growth of GDP (annual average compound rate) 1900–87 | | 3.0 |
| (e) Rate of growth of population (annual average compound rate) | | |
| 1900–50 | | 1.3 |
| 1950–87 | | 0.5 |
| 1900–87 | | 0.9 |
| (f) Rate of growth of per capita GDP (annual average compound rate) | | |
| 1900–50 | | 1.1 |
| 1950–87 | | 3.3 |
| 1900–87 | | 2.0 |

Table 2 is an extract from Maddison. It shows that trends in Canadian GDP growth were well above the OECD average in the 20th century, and more so in the first half than in the second half. A major factor in this growth has been the more rapid growth in Canada's population than the average of OECD countries, both in the first half and in the second half of the century. Canadian productivity growth has not been outstanding, being a little above the average of the OECD countries during the first half of the century, and a bit below during the period from 1950 to 1987.

*Table 2*

### INDIVIDUAL COUNTRY GROWTH PERFORMANCE, 1900–1987

*(ANNUAL AVERAGE COMPOUND GROWTH RATES)*

| | GDP | Population | GDP per capita | GDP | Population | GDP per capita | GDP | Population | GDP per capita |
|---|---|---|---|---|---|---|---|---|---|
| | 1900–87 | | | 1900–50 | | | 1950–87 | | |
| Australia | 3.1 | 1.7 | 1.4 | 2.4 | 1.6 | 0.8 | 4.0 | 1.9 | 2.1 |
| Austria | 2.2 | 0.3 | 1.9 | 0.8 | 0.3 | 0.5 | 4.2 | 0.2 | 3.9 |
| Belgium | 2.1 | 0.4 | 1.6 | 1.3 | 0.5 | 0.8 | 3.2 | 0.4 | 2.8 |
| Canada | 4.1 | 1.8 | 2.3 | 3.9 | 1.9 | 2.0 | 4.4 | 1.7 | 2.0 |
| Denmark | 2.8 | 0.8 | 2.0 | 2.7 | 1.0 | 1.6 | 3.1 | 0.5 | 2.6 |
| Finland | 3.3 | 0.7 | 2.6 | 2.7 | 0.8 | 1.9 | 4.1 | 0.6 | 3.6 |
| France | 2.4 | 0.4 | 2.1 | 1.3 | 0.1 | 1.2 | 4.0 | 0.8 | 3.2 |
| Germany | 2.8 | 0.7 | 2.2 | 1.7 | 0.8 | 1.0 | 4.4 | 0.5 | 3.8 |
| Italy | 2.8 | 0.6 | 2.2 | 1.8 | 0.7 | 1.1 | 4.3 | 0.5 | 3.7 |
| Japan | 4.3 | 1.2 | 3.1 | 2.3 | 1.3 | 1.0 | 7.1 | 1.0 | 6.0 |
| Netherlands | 2.9 | 1.2 | 1.7 | 2.4 | 1.4 | 1.0 | 3.6 | 1.0 | 2.6 |
| Norway | 3.4 | 0.7 | 2.6 | 2.9 | 0.8 | 2.1 | 4.0 | 0.7 | 3.4 |
| Sweden | 2.8 | 0.6 | 2.3 | 2.6 | 0.6 | 2.0 | 3.1 | 0.5 | 2.7 |
| Switzerland | 2.8 | 0.8 | 2.0 | 2.6 | 0.7 | 1.9 | 3.2 | 0.9 | 2.2 |
| United Kingdom | 1.8 | 0.4 | 1.4 | 1.3 | 0.5 | 0.8 | 2.5 | 0.3 | 2.2 |
| United States | 3.2 | 1.3 | 1.8 | 3.1 | 1.4 | 1.7 | 3.2 | 1.3 | 1.9 |
| OECD average | 2.9 | 0.9 | 2.1 | 2.2 | 0.9 | 1.3 | 3.9 | 0.8 | 3.0 |

**Source:** Maddison (1989), Table 1.2.

Table 3 is an extract from Maddison. For the OECD countries, it shows the enormous shift in the structure of employment and output. These data remind us of the enormous exodus from employment in agriculture to both industry and services, and more recently from industry to services. The recent shift of output from industry to services has been less than that of employment, reflecting the higher growth of productivity in industry than in services.

Table 4 is a reproduction from Maddison. It shows the exceptional rate of productivity growth among the OECD countries in what Maddison calls the "Golden Era," between 1950 and 1973. Average growth rates of productivity since then have been a little above those during the first half of the century. The data also show that Canadian growth of productivity was well above the OECD average during the first half of the century, and has been below the average since 1950.

### Table 3

### Long Term Changes in Structure of Employment and Output (OECD average)

| | Employment | | | Value added | | |
|---|---|---|---|---|---|---|
| | Agriculture | Industry | Services | Agriculture | Industry | Services |
| 1900 | 38 | 31 | 31 | 28 | 31 | 41 |
| 1950 | 25 | 36 | 39 | 15 | 41 | 44 |
| 1980 | 7 | 34 | 59 | 4 | 37 | 59 |
| 1987 | 6 | 30 | 64 | 4 | 36 | 60 |

**Source: Maddison (1989), Table 1.4.**

### Table 4

### OECD Productivity Growth (GDP per man hour), 1900–86, for the 16 OECD Countries, Including Canada

| | 1900–13 | 1913–50 | 1950–73 | 1973–86 |
|---|---|---|---|---|
| Australia | 1.1 | 1.6 | 2.7 | 1.8 |
| Austria | 1.5 | 0.9 | 5.9 | 2.8 |
| Belgium | 0.9 | 1.4 | 4.4 | 1.7 |
| Canada | 3.5 | 2.4 | 2.9 | 1.5 |
| Denmark | 2.2 | 1.6 | 4.1 | 1.5 |
| Finland | 2.1 | 2.3 | 5.2 | 2.5 |
| France | 1.6 | 2.2 | 5.0 | 3.4 |
| Germany | 1.5 | 1.0 | 6.0 | 3.0 |
| Italy | 2.4 | 1.7 | 5.5 | 2.1 |
| Japan | 2.3 | 1.7 | 7.6 | 3.1 |
| Netherlands | 1.1 | 1.7 | 4.3 | 1.8 |
| Norway | 2.1 | 2.5 | 4.3 | 3.3 |
| Sweden | 1.6 | 2.8 | 4.4 | 1.6 |
| Switzerland | 1.6 | 2.7 | 3.3 | 1.6 |
| United Kingdom | 0.9 | 1.6 | 3.2 | 2.5 |
| United States | 1.7 | 2.4 | 2.4 | 1.2 |
| OECD average | 1.8 | 1.9 | 4.5 | 2.2 |
| USSR | | | 3.6 | 1.2 |

**Source: Maddison (1989), Table 7.2**

Table 5 is an extract from Maddison. These data show the general trend of convergence of levels of national productivity toward the leader, the United States. There are explainable exceptions, such as the relative decline of Australia and the United Kingdom during the first half of the century, and the setbacks for many European countries and Japan due to World War II. These data also show that the level of Canadian productivity has been second only to that of the United States throughout most of the 20th century.

*Table 5*

COMPARATIVE LEVELS OF OECD PRODUCTIVITY (GDP PER MAN HOUR) 1900–86
(U.S. GDP PER MAN HOUR = 100)

| | 1900 | 1913 | 1950 | 1973 | 1986 |
|---|---|---|---|---|---|
| Australia | 94 | 87 | 64 | 68 | 73 |
| Austria | 47 | 46 | 26 | 57 | 70 |
| Belgium | 63 | 58 | 40 | 62 | 90 |
| Canada | 61 | 76 | 76 | 85 | 89 |
| Denmark | 52 | 56 | 42 | 61 | 63 |
| Finland | 30 | 31 | 30 | 55 | 65 |
| France | 41 | 41 | 38 | 67 | 89 |
| Germany | 49 | 48 | 29 | 64 | 79 |
| Italy | 39 | 43 | 33 | 66 | 74 |
| Japan | 16 | 17 | 13 | 40 | 51 |
| Netherlands | 72 | 67 | 51 | 78 | 84 |
| Norway | 39 | 41 | 42 | 64 | 84 |
| Sweden | 41 | 41 | 46 | 72 | 76 |
| Switzerland | 53 | 53 | 58 | 70 | 73 |
| United Kingdom | 82 | 74 | 54 | 64 | 75 |
| United States | 100 | 100 | 100 | 100 | 100 |
| 15 country average (excluding United States) | 52 | 52 | 43 | 65 | 76 |
| USSR | | | 28 | 36 | 36 |

**Source:** **Maddison (1989), Table 7.3.**

## THEORIES OF ECONOMIC DEVELOPMENT

This paper is concerned with developed economies. Much interest existed in the 1950s and 1960s in explaining the variations in economic development of particular countries over time, and differences in economic development among nations. While there were differences in both the fundamentals and the nuances of these explanations, some common ground is found, particularly regarding the *proximate determinants* of economic development. Many of the examinations proximately explained *levels* of potential (sometimes actual) economic development by treating GDP as a function of the quantities of land, labour, capital, quality of labour, and productivity (more recently, total factor productivity). (See Abramovitz, 1952; Hirschman, 1958; Kindleberger, 1965; Lewis, 1955; Hood and Scott, 1957; and Solow, 1962.)

Derived from this starting point, the *growth* in output was taken proximately to be determined by the *growth* of land in use, the *growth* of the quantities of labour and capital, the *improvement* in the quality of labour, and the *increase* in (total factor) productivity. Attempts to explain changes over time in economic development of a nation or group of nations and comparisons of development among countries were made using these proximate determinants.

For example, for the 16 OECD countries, Maddison bases his proximate explanation of the slower growth between 1973 and 1984, compared with 1950 to 1973, largely on the slowdown in the growth of total factor productivity, and secondarily on the slowdown in capital formation. (See Table 6.)

*Table 6*

COMPARATIVE OUTPUT, INPUTS AND PRODUCTIVITY PERFORMANCE, OECD COUNTRIES (ANNUAL AVERAGE COMPOUND GROWTH RATES)

| Period | GDP | Cropped land area | Quantity of labour input | Labour quality improvement due to education | Capital stock | Total factor productivity |
|---|---|---|---|---|---|---|
| 1950–73 | 5.40 | -0.40 | 0.54 | 0.40 | 4.72 | 3.35 |
| 1973–84 | 2.26 | -0.11 | -0.39 | 0.48 | 3.22 | 1.65 |

**Note:** **Labour is in hours; the figure for labour quality improvement due to education assumes a 0.5 percent proportionate gain in labour quality from a 1 percent increase in educational attainment of the population of working age. Weights used for OECD countries to combine inputs to determine total factor productivity were labour 0.67; capital 0.30; and land 0.03. Weights are proportionate to average shares of factors in total income.**

These figures have to be interpreted with care because of annual differences in utilization of inputs. The slower rates of growth and the reduced inputs used after 1973 are partly due to the greater average degrees of economic slack that followed during the years after 1973.

In the literature on economic development, these proximate determinants raise many questions. What, for example, accounts for and affects "total factor productivity," which rather mysteriously dominates the explanations of growth? How does growth in knowledge generate increased productivity? How much of the transformation is through the embodiment of new knowledge in the stock of capital? What accounts for the continued, though variable, efforts of saving and investment? To what extent is the availability of extensive supplies of labour for small increases in real wages a factor in the differences in economic development? To what degree has the extension of markets been a major factor in explaining variations in economic development?

Many years ago, Kindleberger appraised the situation in words that still apply:

> We have suggested that there is no agreement on how economic development proceeds and have implied that this is because the process is not simple. There are many variables involved, and there is a wide range of substitutability among ingredients — land, capital, the quality and quantity of labor, and technology can substitute for one another, above certain minima, although there are at the same time certain complementary relationships among them. The will to economize and organization are probably the only indispensable ingredients. For the rest, none are necessary, and none sufficient.
>
> The writers who place greater emphasis on one ingredient or another . . . all of them have useful insights. Even the rather rigid stage theories can illuminate the development process, just as in human growth one can propound a wide variety of sets of stages. . . . But the search for a single theory of growth, or a dominant variable, or the key to development is surely too simplistic. It may be less courageous to be eclectic, but it is also more reasonable. In a complex process with many variables and wide ranges of substitution, it is foolhardy to be a true believer in one causal pattern.
>
> Transformation of resources among sectors is a requirement of growth and development in an economy of more than one output. It is called for by the fact that consumption of any one good encounters diminishing returns after a time. As income increases, old wants take smaller percentages of income, and new wants arise. In consequence, resources must be transferred to new occupations.

> The major transformation is from agriculture to manufacturing and services. Productivity is likely to differ between sectors, at any level of income, and to change at different rates. Redundant labor with no (or even negative) marginal productivity is thought to exist as disguised unemployment in overpopulated, underdeveloped countries. If demand increases in the industrial sector, the transfer of this labor into industry can hold down wages, maintain profits, stimulate industrial investment, in a particular model of development "with unlimited supplies of labor." *This model also has historical support and relevance to the recent growth of countries in Western Europe.*[1]

One question that has intrigued economists and others in recent years has been the cause of the slowdown in economic growth throughout the Western industrialized countries since 1973. Even allowing for the *sui generis* growth experience of the "Golden Era" between 1950 and 1973, the subsequent decade and a half or so of growth and inflation has been disappointing. The most obvious explanation has been the decrease in investment and saving efforts.

The proportion of output saved and invested was certainly smaller after 1973 than it was before, in many OECD countries (Boltho, 1988; Dean et al., 1989; and Maddison, 1989). The consensus of respected analysts, however, is that declines in investment and saving efforts are not sufficient explanations of the overall slowdowns in the observed economic growth trends (Slater et al., 1991 paper for Investment Canada). It is noteworthy that the principal cause among OECD countries of the decline in savings efforts was not private saving, but decreased public or governmental saving in many countries.

## THEORY OF INTERNATIONAL AND INTER-REGIONAL TRADE, INDUSTRIAL POLICY AND TRANSPORTATION

### Neo-classical Explanations of Trade and Development

Harris's (1985) study for the Macdonald Commission is a useful basis for the limited consideration that must be given to these topics in this survey.

Harris reviews the neo-classical theory of comparative advantage and its basis on relative factor proportions. His central proposition is that countries (regions) would have comparative advantages in those goods and services that made relatively intense use of their relatively plentiful factors of production. Countries (regions) would and should export those goods and services in which they had comparative advantages. Thus Canada would be expected to be an exporter of wheat, forest products and minerals, and to be an importer of tropical foodstuffs. Transportation costs have often been major factors in determining the degree of specialization. Thus transportation facilities and costs are a significant determinant of trade and development for primary products.

In reviewing neo-classical explanations of trade and development, Harris also acknowledges that some nations (regions) have technological advantages over others for extended periods of time, and that export specialization may reflect these advantages too.

For most of the post World War II period, the United States has been considered the overall technological leader, with the other developed countries engaging in a game of catch-up. This notion has been central to the economic development analyses of Maddison (1989) and Boltho (1988), which emphasize convergence of productivity rates of various nations toward that of the United States. One expression of the technology spread is in the product-cycle literature following Vernon (1966 and 1969).

The main theme of Harris, however, is that although the neo-classical theory of international and inter-regional trade is satisfactory for speciaization in primary products, it requires major modification or additions for trade in manufactures. Harris recalls that many trade studies during the last few decades have shown that the neo-classical theory does not explain world trends in trade in manufactures.

## Harris's New Paradigm

For this, according to Harris, a new paradigm is required. It should explicitly incorporate technology, highly skilled labour, and market structures that are oligopolistic and monopolistic. It should also incorporate economies of various modes of developing, controlling and exchanging information. The focus is on firms. The prize for a firm is innovation. Being first in an activity, and being well along the learning curve, offers advantages of markets and higher income. Comparative advantages can be *engineered*, that is, they can be created by investment in research and development, skills and communications. Nations or regions with such leading activities will climb in the international league of exports, jobs and real income.

As to the location of firms that fit the new paradigm, Harris treats transportation as a relatively insignificant consideration. For most manufacturing industries, transportation is regarded as a minor cost element in production and distribution. Other factors are more important: technology, research and development, professional and managerial people, comparative labour costs and the agglomeration economies of cities.

For a country to successfully pursue Harris's new paradigm, firms have to be *plugged-in* to the international networks of research and development, applications of new technology, engineering, integration of markets, and sources of supply. Transportation and communications for these purposes may not be a large part of the costs of firms, but they are essential. *Transportation of people in the processes of production and distribution of goods and services appears to have become more important than it was in the past.*

Harris notes that:

> the old perspective of looking at transport costs and distance to market as a significant determinant of location of new industry or relocation of old industry is for the most part irrelevant, given that transport costs represent a low share of total cost of most goods. Transport costs are rarely the most significant determinant of location (p. 61).[2]

Harris's main concern is to develop and apply this new paradigm to Canadian industrial output and trade in manufacturing. While he only examines trade in services in a cursory way, the Institute for Research on Public Policy studies of the service industries (Dobell and English, 1988) and the Fraser Institute studies of services (Grubel and Walker, 1989) suggest that the new paradigm is applicable to them also.

Harris does not differ with the leader-follower interpretation of post-World War II economic development of the Western industrialized nations (with the United States as leader), as expounded in Maddison and Boltho. Application of his paradigm, however, suggests two important qualifications. The first is that explanations of variations among nations in their climb in the ranks of productivity performance requires careful analysis of the industrial development of the individual countries. Secondly, the position of "leader" is likely to be shared more widely in the future.

## THEORIES OF PUBLIC GOODS AND PUBLIC CHOICE, AND IMPRESSIONS REGARDING APPLICATION TO TRANSPORTATION: ISSUES OF EXTERNALITIES

For decades now, most developed countries have regarded elements of transportation as public goods on one or more grounds. (See Pigou, 1918; Knight, 1924; Musgrave, 1959; Coase, 1960; Boadway, 1985; Grubel and Walker, 1989; Watson, 1988.) Grubel and Walker, for example, have noted that:

> . . . social benefits of consumption exceed the amount of revenue which the producers can recover through private market sales and which are needed to cover the costs of production (for example, lighthouses, roads, education, defence, police, administration of justice, fire protection, and public transportation).

Costs of collecting fees from users may be so high that incentives for private construction and maintenance of these facilities and services are inadequate to assure an efficient supply. This is often called the *free rider* problem; efficient ways do not exist to exclude non-payers from using a service, such as a highway.

There may be negative externalities, such as noise, pollution and accidents, as well as positive externalities, such as improved access, saving of time, and so on. Yet, there may not be efficient ways to collect appropriate fees from those creating the negative externalities. The public may not even recognize their individual contributions to positive or negative externalities. With respect to traffic congestion, for example, individuals may believe that their additional use of a road adds an imperceptibly small increment to the congestion; thus they may not take it into account in their decisions.

There may also be merit rather than, or as well as, pure economic value to supplying a good or service, as is the case with the contribution of education to an informed citizenry in a democracy.

Markets may also be subject to significant inherent imperfections, such as the markets for health protection insurance and unemployment. In these markets, costs of marketing and administration are high relative to the value of the insurance protection; control of moral hazard behaviour is difficult; and self-selection of risks is likely in a market arrangement.

The good or service may be a natural monopoly; without public intervention of some sort, too little of the good or service may be produced, and too high a price may be imposed. In the past, these considerations prompted public interest in postal services, railroad services, city light services, city electricity and gas services, telephone services, radio and television transmission, and airport services.

A resource may be inherently a common property, such as a fishery, an oil or gas pool, or a common ground owned and used freely by all members of a village. Unless public policy devises means of common exploitation of such common properties, the property may be degraded by individual use, to the detriment of the relevant groups of people.

It has been widely understood for a long time that, for most situations in which there is a public interest, there are many different ways in which that public interest can be exercised. Activities can be privately produced and distributed, subject to taxes and subsidies to users or producers, to regulation of service and price, and to control of supply and use. Activities can be produced by governmental agencies; and the goods or services can be distributed freely, or sold, or subjected to direct or indirect user-charges. Property rights to fish, to search for oil and gas, or to pollute can be created by governments and private groups, and they can be sold in various ways, including public auctions.

Bird (1976) provides a particularly good survey of the theory and practice of user-charges and earmarked taxes in Canada. The Gramlich paper in Munnell (ed.) (1990), "How Should Public Infrastructure Be Financed?" and the Gomez-Ibanez paper in the same volume, "What Are the Prospects for Privatizing Infrastructure? Lessons from U.S. Roads and Solid Waste," reflect U.S. experience and changing views on dealing with public and mixed public-private goods.

The interesting questions for this literature survey are:

- how common are externalities and public goods — particularly in transportation?;
- what is the basis for externalities and public goods?;
- have externalities and public goods changed in any way, particularly with respect to passenger transportation?; and
- have the feasible and efficient ways of dealing with these externalities and public goods changed?

It is not for us to provide expert answers to these questions. Specialized knowledge is needed for that work. Rather, we point to some important suggestions found in the literature.

### Changing Externalities

Massive changes have taken place in the externalities and public goods aspects of transportation. The post office, the railroads, and urban transport are either no longer natural monopolies, or, if still technically natural monopolies, are subject to much more competition. The degree of monopoly power, where some still exists, is much less. Courier services, fax machines, trucking, air freight, and the private car have lessened the power of these former monopolies. The natural monopolies in communications are less secure against competition than they were formerly.[3]

It appears that microelectronic technology is making it possible to impose user-charges efficiently in situations where they could not be imposed in the past (such as the application of electronic surveillance and charging for urban vehicle congestion).

Successful developments in property rights, and conditions for their use, have taken place in a number of other areas: oil and gas exploration and exploitation, *stinting* rights in the east coast offshore fishery, and landing rights and terminal use at airports. Coase (1960) challenges a number of the classic cases for public goods — lighthouses, bees and pollination — with evidence of efficient development of property rights and markets. Coase shows that efficient markets develop over time but only when the market involves a relatively small number of participants.

While the literature indicates that some traditional views of externalities and public goods have become (or are becoming) less persuasive, it also suggests that some externalities and public goods are becoming more important. These include transportation.

The most prominent negative externality is the atmospheric pollution produced from the burning of hydrocarbons by cars and trucks. Noise and accidents are also of increasing concern.

Positive externalities receiving increasing attention in the literature include improvements in the time taken to produce and distribute goods, and increases in the reliability of truck transportation. Just-in-time inventory and production arrangements have received a good deal of attention in recent years, according to Hickling (1990). So have improved distribution arrangements says Quarmby (1989).

### Externalities and Government Intervention

The economic case for government intervention in transportation is still compelling. Nonetheless, it has been challenged a good deal in the last three decades by concerns over the possible inefficiencies of governments. The challenge has been systematized in the theory of public choice (notably by Buchanan and Tullock, 1962. See also Watson, 1988 and Grubel and Walker, 1989).

Since transportation, historically, has been one of the major activities subject to public interest and alleged externalities, it has accumulated an enormous body of government interventions. Common observation reveals an enormous buildup of groups with vested interests in the continuation of these interventions, including businesses, politicians, bureaucrats, labour organizations, local communities and lobbyists. These groups are clearly visible whenever changes are proposed. Thus, the concern of public choice analysts with the inefficiency of government also applies, in some measure, to transportation.

With respect to infrastructure, including transportation, the battles between proponents of economic efficiency and other values and considerations have intensified recently. A particularly clear and intense example is found in the papers and comments by Winston and Altshuler in Munnell (ed.) (1990).

Winston is a well-known and respected analyst and advocate of economic efficiency in the investment and pricing of highways and airports. But, in this paper, he detects an increased concern for economic efficiency among decision makers for transportation.

Altshuler, a political scientist and experienced public official, and now Professor of Urban Policy and Planning at Harvard, challenges this view. His doubts are reminiscent of the arguments in the 1930s about the compatibility of democratic governments and effective economic organization and acceptable sharing of income. After setting out his pessimistic view of democracy in the United States, Altshuler notes:

> American infrastructure policy has been far more responsive to group pressures and broad popular attitudes than to efficiency arguments, and . . . it is likely to remain so. . . . road congestion charges remain a political loser. . . . a shift in the basis of truck taxation from gross weight to axle weight . . . is plausible. . . . The more difficult question is whether trucking taxes will increase sufficiently under this scheme to bring about a major reduction in the implicit subsidy that heavy trucks have long received. Here I have severe doubts, since the general nature of the subsidy has been well understood for decades. . . .
>
> I believe that pricing strategies to alleviate airport congestion are forthcoming. Air traffic delays are of interest to large numbers of voters as well as to commercial airlines. It seems unlikely that runway and terminal expansion, or air traffic control improvement, will be sufficient to alleviate airport congestion in the face of rapid traffic growth in the decades ahead. The great question is whether the problem will become so severe that politicians are willing to challenge the general aviation lobby. (pp. 210–11)

Similar political economy questions arise from related papers. In the public finance literature, user-charges and earmarked taxes have had much support. Gramlich's paper in Munnell (ed.) (1990) is a recent illustration. Yet user-charges and earmarked taxes are not often utilized. When they are, these systems tend to be poorly designed. Privatization of pure public goods has been recommended by many economists, but little privatization has taken place. Why? Altshuler's arguments about the values, special interests and inertias of U.S. democracy are too extreme. Nevertheless, the limited success of economic efficiency arguments suggests that Altshuler's approach should be given careful consideration in the formulation of public policy, particularly with respect to transportation.

## MACRO VIEWS ON TRANSPORTATION AND ECONOMIC DEVELOPMENT

In the literature on economic development, Kindleberger has also made some wise observations on transportation and communication. He considers increasing the size of the market important not only to the exploitation of comparative advantages of regions, but also to the pursuit of economies of scale in a world that is far from purely competitive. The linkage of markets by improvement in transportation, or by an improvement in a product that makes it lighter and more readily transported, becomes part of a development process.

"It is not surprising," says Kindleberger, "that economic development is correlated positively with transport facilities." This is illustrated by international comparisons of the density of railroad lines of nations compared with income per capita, and density of roads, compared with income per capita. Kindleberger also cites illustrations of post-1870 expansion of trade and transport, and the growth in per capita income.

Kindleberger *links contributions of communications and transportation.*

> Too little attention is generally paid in these accounts . . . [of economic development] to the spread of communication needed to link markets. . . . Along with transport, or rather some distance in advance of capacity to transport, there must be a network of communication, which is vital to market operation.[4]

### History of Transportation as a Contributor to Economic Development

It is not necessary to deal at any length or in detail with the general economic history in which transportation is given much credit as a contributor to economic development. A few reminders of that history will suffice:

- The faster growth of trade than of output throughout the developed world is well known, and it could not have taken place without improvements in transportation and communication.

- The historical economic geography of Canada in the 20th century as presented so beautifully in Volume III of the *Historical Atlas of Canada*, shows the connections between transportation and economic development in this country.
- The travel sections and advertisements in the weekend newspapers are visual evidence of the enormous growth of the tourism trade, an industry in which transportation is an essential ingredient.

## DISAGGREGATED MACRO MODELS OF INFRASTRUCTURE, TRANSPORTATION AND NATIONAL ECONOMIC DEVELOPMENT

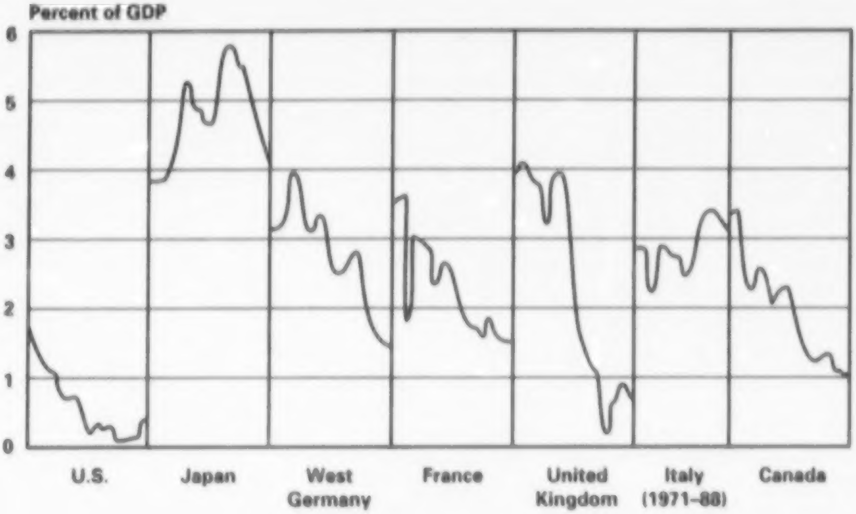
Ordinary observation[5] has linked the deterioration of infrastructure, increased congestion, decreased investment in infrastructure and slower economic growth during the last 15 years in the United States and Canada. Infrastructure deterioration has often been attributed to decreased investments in transportation systems. This is one important cause of slower growth and smaller increases in productivity. (See Choate, 1984; Governors' Task Force, (1989; U.S. National Research Council, 1988; U.S. Congress, Joint Economic Committee, 1989; Munnell, 1990c; and Munnell (ed.), 1990a, particularly papers and comments by Aschauer, Aaron, Musgrave, Munnell, Hulten, Friedlaender, Peterson, Blinder, and Tarr.)

At the most general level of observation, public investment declined as a share of gross domestic investment in the Big Seven of the OECD members between 1967 and 1985. Chart 1 is reproduced from Aschauer (1989c). As is known from Dean (1989), gross investment as a share of GDP declined during the same period, and public investment as a share of GDP markedly decreased.

The Canadian National Income and Expenditure accounts show the decrease in government gross fixed capital formation in recent years. Table 7 summarizes the post-World War II record.

*Chart 1*

## PUBLIC INVESTMENT AS A SHARE OF GROSS DOMESTIC INVESTMENT: 1967–1985



Source: National Accounts (OECD). Reprinted from Aschauer (1989c).

*Table 7*

## CANADA — SUMMARY OF GROSS FIXED CAPITAL FORMATION AS A PERCENTAGE OF GNP AND GDP

| Period | Government Gross Capital Formation | Business and Housing Capital Formation |
|---|---|---|
| | As a percentage of GNP | |
| 1950–54 | 3.09 | 18.18 |
| 1955–59 | 3.82 | 20.50 |
| 1960–64 | 4.21 | 17.20 |
| 1965–69 | 4.22 | 18.60 |
| 1970–74 | 3.72 | 18.63 |
| 1975–79 | 3.29 | 19.81 |
| | As a percentage of GDP | |
| 1975–79 | 3.32 | 22.00 |
| 1980–84 | 2.88 | 20.04 |
| 1985–89 | 2.42 | 18.63 |

**Note:** Investment and GNP figures are calculated from Department of Finance, *Economic Review*, 1990. Investment and GDP figures are calculated from Statistics Canada, National Income and Expenditure Accounts, March 1991 (latest number).

## INVENTORIES OF DEFICIENCIES OF INFRASTRUCTURE

Inventories of the amount and quality of infrastructure deficiencies have been compiled in Canada and the U.S. by central governments, states and provinces, cities, and highway authorities. (See Choate, 1984; Congressional Budget Office, 1983; U.S. Governors' Task Force Report, 1989; Joint Economic Committee, U.S. Congress, July 1989; and Federation of Canadian Municipalities, 1985.)

These inventories of deficiencies usually involve a comparison of what exists with some specified desirable standards, such as road conditions, levels of congestion and environmental standards. Most of these standards are derived from engineering criteria rather than from economic ones. They do not usually deal with the issues of specific links between infrastructure and economic development. (See Batchelder, 1979; Hickling, December 199); David Lewis et al., 1988; National Council on Public Works Improvement, 1988.)

Recently, however, a number of macroeconomic studies exploring the quantitative linkages of infrastructure in general, and transportation in particular, to economic development have appeared. In order to consider the relationships of particular factors to potential and actual economic growth, it is necessary to disaggregate the general models of economic growth. This is equally so for education, training and retraining programs, research and development, transportation development, and so on.

The best known of these quantitative studies are by Aschauer (six articles between 1988 and 1991 are listed in the bibliography). Other prominent studies are those by Deno (1988), Eberts (1991), Fox — a detailed evaluation of a large body of empirical work of this type — (1990), and Munnell (1990b).

The Aschauer studies focus on treating private capital and public capital (or types of public capital) as separate determinants in a production function linking outputs, such as GDP, to inputs, such as quantity and quality of labour and technological change. Various formulations of the production function are used in the articles. Surprisingly large increases in productivity are attributed directly or indirectly to public capital (for example, through the stimulus of public capital to the productivity of private capital). The studies make comparisons over time, across countries, among regions, and among sub-sectors of economies such as manufacturing. Qualitatively similar results have been generated from these studies, such as large contributions to economic growth from infrastructure, though with substantial differences in the quantitative results.

These results have met with profound scepticism from some analysts, notably by Schultze (1990), Aaron (1990) in Munnell (ed.), Musgrave (same volume) and Winston (1991).

Notes Schultze:

> According to Aschauer's regression, (March 1989) a 1 percent increase in the stock of public infrastructure raised the level of output — everything else held constant — by 0.39 percent during the period from 1949 to 1985. By virtually all estimates, that increase was larger than the gain in output from a 1 percent increase in the stock of private business capital. Yet the stock of business capital (in 1987) was 3.3 times the size of the stock of public capital. (p. 63)

Says Schultze:

> Those same results also imply that a one-time increase of $10 billion in the net stock of public infrastructure would yield a permanent increase of $7 billion in the annual level of GNP. While not a free lunch, this would be a very cheap banquet. (p. 63)

Aaron (1990) in Munnell (ed.), notes that:

> David Aschauer has made one of the more fascinating and important contributions to this debate [concerning the growth slowdown]. He has called attention to the rather extraordinary disregard by economists and others of the possible role of public investment in explaining the slowdown. He has produced a series of papers in support of his contention that a sharp deceleration of public investment, especially investment in what he calls "core infrastructure," is very nearly sufficient to explain why growth slowed in the United States. . . . The paper presented at this conference continues his efforts to marshall support for this thesis. . . . Aschauer has had a valuable insight but has greatly exaggerated its quantitative importance; this paper does little to advance the thesis he propounded elsewhere. (pp. 51–52)

According to Winston (1991):

> Some readers may be familiar with the work of Aschauer (1989), who estimates time series regressions that attempt to explain the impact of the nonmilitary public capital stock on the nation's productivity, and finds very powerful effects. In fact, the effects he finds are too powerful.
>
> Consider a one-time lump-sum $60 billion increase in infrastructure spending. An increase of this magnitude in 1985 would enable public works capital spending to regain its 1960 share of GNP. This lump-sum investment represents a 6 percent increase in the value of the infrastructure stock. Using Aschauer's elasticity estimate of .24 for the change in productivity with respect to the change in the infrastructure capital stock leads to a 1.4 percent increase in current output from the investment or a $70 billion gain in the first year. With conservative parameters, the present value of the gain in future years would exceed $600 billion, for a benefit-cost ratio of 10:1.
>
> This return is implausible. Charles Schultze (1990) argues [that] Aschauer's findings simply demonstrate that the time pattern of productivity and public investment growth are similar (both rising in the 1950s and 1960s, and both falling in the 1970s and 1980s), and that this correlation generates grossly inflated estimates of the return to public infrastructure investment. (p. 126)

Munnell (1990a and b), in careful work, has produced some more modest quantitative estimates than Aschauer; she continues to attribute importance to his general theme.

While not accepting entirely the arguments of Aschauer and company, Hickling gives some weight to the notion that the record of infrastructure investment has been a factor in productivity experience. This view appears to be based in part on other indicators of accumulated under-investment in infrastructure in general, and in transportation in particular.

### The Fox Paper[6]

A brief review of the Fox Paper is warranted because it is the most comprehensive and sensible evaluation of a large body of recent theoretical and empirical work.

Despite all the limitations and difficulties of the recent macro and sub-macro investigations of infrastructure and economic output, Fox concludes that some cautious conclusions may be drawn:

> - Public capital investments can increase production.
> - The mechanisms through which public capital affects output include:
>     - complementarity between the public capital stock and private capital;
>     - public capital operating as an input directly in the production process;
>     - Keynesian demand effects from construction.
> - Public capital investments are subject to diminishing and potentially negative returns.
> - Investments in core infrastructure, and particularly transportation and roads, appear to offer the greatest productivity gains. Water and sewer and communications are also productive.
> - The relative effects of marginal public investment at a particular site depend on the structure of industry where the investments are made, characteristics of other inputs available in the region, current infrastructure levels, and demand for output that would be produced in the region. . . .
> - Public capital investments may crowd out private investment, but the net effect of new infrastructure still can be greater private investment and production if the complementary relationship between public and private capital in production offsets contemporaneous crowding out. (pp. 47–48)

Fox notes that:

> . . . the major limitation of the research is it has little, if any, direct policy application, though it has been useful in expanding economists understanding of infrastructure's role in the economy. . . . With continued research we can continue to expect development of sound guidelines for answering these questions and targeting investments to those

> locations where they are likely to be most effective. *However, the guidelines will only assist in making the best decisions and need for careful benefit/cost analysis to consider the specific merits of individual products will remain as important as ever.* One guideline already apparent is that infrastructure needs vary widely by region and country. [emphasis mine] (pp. 48 and 51)

### Fox's Approach

For those interested in technical analysis, a brief review of Fox's approach will be of interest. He begins by setting out a framework that can be used for evaluating the variety of theoretical and empirical macro literature.

One part of the framework is a generalized form of an aggregate supply function which, among other things, treats private and public capital as separate inputs. Another part is an aggregate demand function that is a mixture of full-employment growth and Keynesian elements, but with explicit distinct treatment of private and public investment demand. A third part is a function generating public capital stock and investment. Along with some other secondary functions, but not with a complete simultaneous equations specification, Fox uses the interaction of the aggregate supply and aggregate demand functions as the determinant of the infrastructure-output relationships.

Fox examines a large number of empirical studies of various aspects of these relationships, which are based on time-series and cross-section data, nationally, internationally and regionally. After a careful critique of these studies, he comes to the conclusions set out above.

## THE LITERATURE ON TRANSPORTATION AND ECONOMIC DEVELOPMENT

A considerable amount of literature now exists under this heading. It comprises books and articles that examine theoretical, empirical and policy considerations. Much of the literature recognizes the economic benefits of transportation, as well as the military, social and political benefits. As to economic benefits, some are conventionally counted in national income. However, many economic benefits that are important are not so measured, including time saved outside working hours; congestion reduced; safety improved; and emissions reduced.

The literature on transportation and economic development is generally about *the comparison of economic costs and benefits* of the construction and operation of various kinds of infrastructure. A project is considered to be a net contributor to economic development if its benefits, comprehensively measured and properly discounted, exceed its costs, also comprehensively measured and properly discounted. The literature considers the value of economic development of projects in such diverse fields as waterways, ports, irrigation, soil conservation, railroads, highways, and urban transportation. Much of the literature since the end of World War II has been concerned with developing countries. The World Bank has been an important centre of such studies. But the concepts and principles of measurement of infrastructure contributions to economic development (including transportation) are essentially the same for developed countries as they are for developing countries.

While the application of the cost-benefit approach to infrastructure may be more difficult, because of the absence of markets in many of the benefits, and the conditions of use, the consensus appears to be that the same concepts and principles apply, whether one is considering the contribution to economic development of a steel mill, a shopping centre or a new office building.

A consensus among economists on the appropriate concepts and measurements had appeared by the early 1960s in such works as Eckstein (1958); Krutilla and Eckstein (1958); Fromm (ed.) (1965); Mohring and Harwitz (1962); and Owen (1957). These concepts and measurements differed significantly from those generated in the engineering literature which dominated the planning and decision making of infrastructure at that time. The economic concepts considered to be relevant today (see Hickling, 1990) are essentially updated versions of the earlier economic work. While these economic criteria appear to be given more weight now than they were earlier, the literature suggests that engineering criteria still dominate planning, decision making and evaluation. Also, when the economic criteria are introduced, major errors of application occur. The alleged results are major economic inefficiencies (see Hickling, 1990).

Adler's article, "Economic Evaluation of Transport Projects," in a volume edited by Fromm (1965), is a clear and persuasive presentation of the economic principles and their applications.[7] The tone of his presentation is established at the outset:

There is . . . no causal relation between the backwardness of the economics of transport evaluation and the fact that until a few years ago it was virtually the exclusive domain of engineers. On the contrary, this condition is to a considerable extent due to the failure of economists to interest themselves in this area even though it is one in which close cooperation between economists and engineers is especially important. As a result, some of the most common mistakes in project evaluation result from the failure to apply economic criteria correctly or at all; a few of these, such as the failure to distinguish between private and public costs and benefits and between average and marginal costs, are discussed below. . . . (p. 171)

The basic purpose of the economic evaluation of a project is to measure its economic costs and benefits in order to determine whether its net benefits are at least as great as those obtainable from other marginal investment opportunities in the particular country. There are, of course, many costs and benefits other than economic ones, such as the cultural opportunities from greater travel and the military and administrative advantages, and sometimes disadvantages, from greater mobility. These are not considered here . . . [for various reasons. . . .] (p. 173)

It is sometimes stated that the value of a project should be measured by its contribution to the growth of national income as conventionally measured. This is not inconsistent with the above formulation, but it is not a practical approach. For one, it would exclude certain benefits altogether, such as greater comfort from an improved highway, or the time saving used for more leisure, which would not be reflected in national income. More important, the national income approach is too complicated and indirect. . . . However, the national income approach is useful in focussing on costs and benefits from the point of view of the economy as a whole and not merely of the parties directly involved. In this way it helps in selecting the benefits to be included and those to be omitted and in avoiding counting the same benefit twice in different forms, such as when an improved highway reduces transport costs and increases land values. (pp. 173–74)

In order to measure economic benefits and costs and to compare them with other investment opportunities, they must be expressed

> in monetary terms, which is the only practical common denominator. This presents a problem since market prices do not reflect real costs to the extent that workable competition does not prevail in major sectors of the economy. . . . [T]here are two special problems. . . . The first one arises from the fact that some transportation services by their very nature are oligopolistic or even monopolistic so that the prices charged for these services frequently have no direct relation to costs. . . . A second related problem arises from the direct and indirect subsidization of many transportation services by governments. . . . [G]asoline taxes and other charges on the beneficiaries do not cover the costs of highways (including maintenance, depreciation, interest, and administration); even where they may cover overall costs, there is usually no direct relation between specific user charges and the differing costs of the various transport services, such as those of trucks, buses and passenger cars. (pp. 174–75)

### Measuring Economic Costs

Adler then turns to measuring economic costs, which he notes is substantially simpler than measuring economic benefits and can usually be limited to making adjustments in expenses. Sales and indirect taxes, licence fees and import duties should not be included in the costs, as they are not social costs. Wages ought to be measured on a social opportunity cost basis. The economic cost of capital should be on the social opportunity cost, which Adler suggests was in 1965 for developing countries at least 8 percent real and frequently more than 10 percent. The equivalent for capital-exporting developed countries would be lower at that time. Adler writes:

> The problem of the appropriate interest rate can be minimized somewhat in the evaluation of many projects by expressing the results in terms of an internal rate of return on the investment, rather than in terms of [a] benefit-cost ratio. (p. 176) [The profession now considers the comparison of discounted benefits and costs to be a more satisfactory approach. Even when internal rates of return are used, they have to be ranked and compared with hurdle rates of costs of capital. Thus the internal rate of return does not permit escape from the difficulties of selecting a cost of capital.]

Adler notes that the costs of developing projects often occur sooner than the benefits. Accordingly, it is necessary to put both on a present-value basis at the same time, and the best reference point is the date when the project began.

Adler also notes that ancillary works necessary to the functioning of the main new transportation project should be included in the overall evaluation.

### Measuring Economic Benefits

Adler then turns to measuring economic benefits. He indicates that this is usually much more difficult than measuring economic costs because:

- some benefits . . . such as the increased comfort and convenience . . . are difficult to express in monetary terms since there are usually no market prices for such benefits. . . .
- monetary benefits, such as reduced transport costs, benefit a great number of people over a long period of time, requiring difficult long-range forecasts. . . .
- many benefits are indirect, such as the stimulation to the economy from improved transportation; and for these benefits to materialize, investments in fields other than transport are frequently necessary. (p. 179)

He notes that the most important benefits from transport projects include:

- reduced operating expenses initially to the users of the new facility and also usually to those who continue to use the existing facilities;
- lower maintenance costs;
- fewer accidents;
- savings in time for both passengers and freight;
- increased comfort and convenience; and
- stimulation of economic development. (p. 179)

Adler emphasizes, like Mohring and Harwitz, the distinction between size of benefits and their distribution. It is likely that the benefits of transportation developments will be widely dispersed in ways that depend on the nature of markets, government regulations and so on. This results in double-counting when measuring the size of benefits. It also gives rise to difficult substantive issues because the size of the benefits depends on their distribution. If, for example, a transportation project stimulates a large increase in use, the size of the benefits may be quite different than if usage is changed little.

The most direct benefit from a new or improved transport facility, and frequently the most important one, is the reduction of transport costs. In measuring this, Adler insists that *the proper method is a with-and-without test, rather than a before-and-after test.* Bearing in mind the dynamics of growth of usage and other factors, what would have been the profile of costs over time without the project? What will be the profile of costs over time with the project? The before-and-after test is commonly used to measure the benefits, usually resulting in gross over-estimates of the economic benefit.

The reduction in transportation costs counted should be the marginal cost of the movement rather than differences in average costs between the with-and-without situation. If, for example, a highway development diverts traffic from railroads to highways, which have lower costs, the benefit or saving is the marginal cost of saving railroad transport costs, not the difference between the average cost of movement on the highway and the railroad. Use of average costs to measure benefits may exaggerate considerably the benefits of the highway project.

Total distribution costs, not just costs of shipment, are the primary concern. If a project reduces costs of loading and unloading, storage, insurance, breakage, and so on, as well as shipping costs, these other benefits have to be factored into the evaluation of the transportation project being considered.

Also, in evaluating a transportation project, account must be taken of the new traffic that is created. Benefits in accident reduction and time savings are often crucial. Though difficult, they have to be translated into monetary terms to make a proper evaluation. Saving in inventories can be a particularly important result of a transportation project.

Adler is noncommittal about the economic development benefits of transportation. He notes that:

> It is frequently assumed that all transport improvements stimulate economic development. The sad truth is that some do, some do not, and that even some of those that do may not be economically justified in the sense that there may be better investment opportunities. Each project must therefore be investigated individually and no helpful generalizations appear possible until more research may show that certain definite correlations do exist.
>
> Before any transport improvement can be said to have stimulated economic development at all, a number of conditions must be met. The most important is showing that the economic development would not have taken place in any case even without the transport improvement. A second is that the resources used in the new development would otherwise have remained unused or used less productively. Finally, it is essential that the economic activity stimulated does not replace activity which otherwise would have taken place.
>
> These conditions may be obvious, but it is surprising how often they are forgotten in practice. . . .
>
> Where a transport facility does lead to increased output and the above conditions are met, the net value of this additional output is the proper measure of the economic benefit. In many situations, however, the transport facility is not the only new investment needed to achieve the increased production. This raises the problem of allocating the benefit . . . among the transport and the other investments. For this there exists no correct theoretical answer but there are at least three practical approaches. One would be not to make an allocation at all and relate the total benefits to the total investments. A second would be to annualize the other investment costs and deduct them from the benefits. A third would be to allocate the benefits in the same ratio as the transport investment has to the other needed investments. (pp. 189–90)

## Comparing Costs and Benefits

Adler notes that:

> Once costs and benefits have been measured in monetary terms to the full extent meaningful, the results can be put into at least three different forms:

> - the rate of return on the investment;
> - the benefit-cost ratio; or
> - the pay-back period. . . .
>
> While the basic ingredients — the value of the costs and benefits — are the same regardless of the final form in which they are expressed, the usefulness of the various forms is different, depending on the purpose. A short pay-back period is important where the future is unusually uncertain, where better investment opportunities are likely to arise soon, or where funds are not available on a long-term basis. . . .
>
> Discounting benefits and costs by the opportunity cost of capital is theoretically the best way of comparing different projects. The most important disadvantage of this approach is that a particular interest rate must be chosen for discounting. . . .
>
> This disadvantage can be minimized somewhat by expressing benefits and costs in terms of the internal rate of return on the investment, i.e. the rate which equalizes discounted costs and benefits. In this case, the opportunity cost of capital becomes important only in the marginal cases where the internal rate of return is not clearly above or below the area within which the opportunity cost of capital may be estimated to be. . . .
>
> [T]he rate of return formula has the practical advantage that economists, financial experts and many businessmen have some concept of what an interest rate is, so that a rate of return is probably more meaningful to many audiences than a benefit-cost ratio. On balance, therefore, the internal rate of return on the investment is usually, but not invariably, the most satisfactory form in which to express benefits and costs of transportation projects in the less developed countries. (pp. 192–94)

As noted above, the economic and financial profession now prefers cost-benefit ratio calculations over internal rates of return because they demand the ranking of possible projects. Also, the same judgement is required for the social cost of capital to decide on investment programs.

## CAN GENERALIZATIONS BE MADE ABOUT OVER- AND UNDER-INVESTMENT IN TRANSPORTATION AFTER EXAMINING THE PROJECT EVALUATION LITERATURE?

Adler does not provide a general answer to this question. Individual projects, however they are decided upon, may be put through the benefit and cost evaluation. From the enumeration of the difficulties and possible mistakes, it appears that Adler believes that errors of both kinds arise. Some projects are undertaken or mooted, though a proper benefit and cost calculation would indicate that they are far from worthwhile in terms of economic value. Some projects are not undertaken, though a benefit-cost screening suggests that they would be worthwhile. It is not clear in Adler where he considers the balance of errors to lie.

Mohring and Harwitz (1962) are more daring. They write:

> A limited investigation of the subject suggests that the methods presently used to measure these "benefits on existing highway use" on balance understate their values substantially. [A footnote suggests that too small a rate of interest discount is generally applied]. Those who have undertaken such studies have typically used very conservative values to estimate those user benefits which are difficult to quantify. Two groups of benefits in this category are particularly worth mentioning: (1) benefits to users of substitute facilities; and (2) the value of time saved. (pp. 18–19)

Mohring and Harwitz (1962) are also concerned with what measure of benefits would be comprehensive but not subject to *double-counting*. They write:

> Presuming that all of these measurement problems had been surmounted and that a close estimate of the reduction in the time and dollar transportation costs afforded by a highway improvement had been obtained, would this estimate in fact cover *all* of its "benefits on existing highway use"? An unqualified "yes" answer seems in order . . . most of these presumed additional benefits actually involve income or substitution effects . . . or benefit transfers. Both true and internal transfers of these benefits undoubtedly take place. . . . *However, it must be remembered that a transfer represents the passing-on of a benefit and not the generation of an entirely new benefit* [emphasis mine].

> Much of the same argument applies to the first of the substitution benefits enumerated above — that of a highway for other forms of transportation. The only net benefit is the associated saving in transportation costs, a benefit which is, to repeat, typically underestimated. (p. 22)

As indicated at the outset, Hickling's *Primer* (1990) appears to me as an up-to-date tackling of the decision-making and benefit-cost literature of the late 1950s and early 1960s. It deserves a more careful review in this survey, which is done below. Meanwhile, it is worth mentioning that Hickling's concepts, and its judgement about under-estimation of the benefits from transportation projects, are consistent with those of Mohring and Harwitz. Incidentally, Hickling favours benefit-cost ratios over internal rate-of-return measurements.

*Though the regional material will be developed in a separate section of the survey, this is an appropriate place for a brief discussion of regional literature.*

## REGIONAL INFRASTRUCTURE (PARTICULARLY TRANSPORTATION) AND ECONOMIC DEVELOPMENT

The literature includes many books and articles on these subjects, applying both the macro and sub-macro methods of analysis, and cost-benefit analyses.

Providing that the regional definitions and measurements of output and inputs are correct, in principle, similar conclusions can be drawn about regional infrastructure and economic development as are made about national infrastructure and economic development. Indeed, many of the studies reviewed by Fox (1990) attempt just such analyses.

Similarly, in principle, cost-benefit analyses are fully applicable to regional infrastructure (and, in particular, transportation projects). In fact, since the outcomes depend on regional or local conditions and the application of other factors, regional or local venues are the preferred cases for cost-benefit analysis.

As Mohring and Harwitz (1962) argue, the fact that many of the benefits of transportation projects in one region are shared with other regions is not, in principle, a deterrent to the evaluation of the projects. Size of benefits is one thing; distribution of them is another. Both authors recognize, however, that size of benefits may depend on distribution, and this has to be taken into account.

While, in principle, the measurements and evaluations of regional projects are achievable, in practice there appears to be a good deal of double-counting and window-dressing in the analysis of regional infrastructure and economic development.

Systematic review of the regional economic development literature and transportation is presented in Part B of this review. Among those reviewed are: Courchene (1981); Eberts (1991); regional aspects of Fox (1990); Friedlaender (1990); Freidman and Alonso (1964); Kraft, Meyer and Valette (1971); Munnell (1990a); Savoie (1986); and Sullivan et al. (1989).

**Hickling**: ***A Primer on Transportation and Economic Development***

For the purposes of the Royal Commission, Hickling's *Primer* is the most useful piece of literature available.

- Hickling judiciously blends the macro and micro evaluation and decision-making approaches (which the *Primer* calls the indicative planning methodologies and the investment choice methodologies).
- While putting primary emphasis on goals of economic growth, economic welfare and improvements in living standards, it provides for incorporating regional and distributional objectives.
- It provides a sound basis for evaluating benefits, costs, and benefit-cost comparisons; and for dealing with discounting of costs and benefits.
- It points toward the dynamics and efficiency considerations that are appropriate to establishing the *base cases* against which new projects should be compared.
- The *Primer* provides a convincing comparison of engineering and economic criteria for evaluation and decision making for transportation projects. It also provides an impressive survey of current practices and common errors, without being "smart-alecky" or "preachy."
- It incorporates logistical and environmental implications of transportation projects.

- The *Primer* points toward sensible answers to the questions of over- and under-investment in transportation projects.
- It recognizes that we live in a world of risk and uncertainty, and have to decide upon and evaluate transportation projects accordingly.
- It is written in non-technical language.
- And finally, the *Primer* is educational rather than critical in tone.

Here are a few highlights from the *Primer*:

- "Growth for growth's sake has never been the center-piece of American public policy. Nevertheless, the fact stands that growth, through acceptable means and at acceptable costs — sustainable development — is the only means available to recover and sustain ground in American living standards, and most of the increased growth can be achieved only through increased levels of productivity." (p. 1)
- "There is wide-spread agreement that higher rates of capital investment are key to the future growth of productivity and living standards." (p. 3)
- "In the public sector, where market forces are weak, special efforts must be made to ensure that infrastructure investment matches and enhances productivity gains in the private sector." (p. 3)
- "In the case of transportation infrastructure . . . [u]nless these investments yield economic gains, including productivity gains, that exceed the costs of achieving them, they will make no contribution to the nation's overall rate of economic expansion. Interregional competition, like competition generally, is a healthy thing. But when a region grows at the expense of others without generating a net contribution to the sum of all economic activity, living standards for all will stagnate and decline over the long-term." (p. 5)
- "At a minimum, decision makers need to assure themselves that policies and programs will make a net contribution to economic growth. . . . [They] do not have to settle for only the most highly stimulative projects; a poorer locality might warrant project funding even though its proposal offers less potential for productivity growth than the proposal of a wealthier region. *But any project should offer at least a minimum net contribution to economic growth to stay in the running* [emphasis mine]." (p. 14)

- As a primary objective, Hickling recommends *growth in total economic welfare*, that is, "increased economic benefits that exceed the increased economic costs of achieving them. '*Welfare*' is distinguished from '*output*' in that welfare includes factors, such as time and safety, that have economic value but are not included in the normal accounting definitions of economic output and gross product." (p. 15)
- "While productivity gains alone can often justify transportation investment, this is rarely the case with employment, income and other targets of regional redistribution." (p. 20)
- Regarding negative environmental impacts: "The critical issue therefore is not whether such transportation investments are environmentally sustainable, but rather how to devise policies that make a portion of the benefits available to finance the mitigation of negative environmental impacts." (p. 24)
- "How can a "minimum-required contribution" to economic growth be defined in practical terms? The operational approach . . . is through use of the rate-of-return concept commonly applied in investment planning generally." (p. 26)
- "Two errors are quite common in recent practice. The first is a marked confusion between distributional aims and aims relating to economic growth. It is not unusual, for example, for the projected employment and related economic ripple effects of an investment to be regarded as evidence of economic growth and singled out for measurement as key program objectives . . . . A second common error is failure to conduct the kind of analysis needed to measure the prospective growth implications of policy and program options." (p. 29)
- *Indicative Planning Methodologies*, which attempt to determine how much infrastructure spending is enough. Hickling reports on, and evaluates as a useful tool, the methods based on the infrastructure-productivity statistical analysis of Aschauer et al. (The Hickling paper is more impressed by the measurements of Aschauer et al. than I am.) *Hickling is cautious about the practical applications of such analysis*: "While the application of indicative planning methodologies can help executives identify gross under- and over-investment levels from a budgetary perspective, only the application of forward-looking [investment choice] methodologies can identify the most promising investments and distinguish strong from weak transportation program and project choices." (pp. 34–37)

- *Investment Choice Methodologies* are the heart of the *Primer*. "Whether growth is defined in terms of productivity, gross output or economic welfare and living standards, it can only occur if more of value is put into the economy than is taken out (spent) in order to achieve it. Only by gauging transportation policies and investments in terms of their rate-of-return and net present value can decision makers discern their implications for productivity and economic growth. . . . [T]he state or local transportation analyst needs to ask whether the economy as a whole will be made better off by undertaking the project rather than not undertaking it, or by undertaking an alternative project instead." Hickling then compares the key measures of productivity and economic growth. (pp. 37–49)

- For a number of cases, Hickling compares commonly used engineering decision-rules with economic rules based on net-present-values. *They show that the economic measure of benefit commonly exceeds that arising from engineering decision rules.* Other things being equal, this evidence points to a bias toward under-investment in highway and airport projects in the United States. (pp. 43–44)

- "Sound economic decisions in investment planning necessitate that major new policies, programs and investments be approved only if they can be justified after accounting for the impact of developments and actions that lead to the most efficient use of existing facilities. Rarely is it the case that "nothing happens" to improve current systems in the absence of major investment. The 'nothing happens' and 'do-nothing' baselines of comparison for prospective new policies assume that the transportation system and related patterns of economic activity will reflect the status quo in the absence of investment. This assumption fails on three counts:
    - First, it fails to adjust demand for a program or a project's services to the no-investment case. . . .
    - The second problem inherent in the status quo baseline is that it ignores steps available to state and local transportation authorities to improve the productivity of transportation systems in lieu of major expansion [for example, by the use of congestion pricing].
    - The third intrinsic problem in a base case defined by status quo conditions is that it can inhibit a broad search for innovative policies and programs of solving problems. . . ." (pp. 63–65)

The remainder of the Hickling study is a thorough, and by now fairly orthodox primer on identifying benefits and costs and applying benefit-cost analysis. It is worth noting that the Hickling study considers that the time-saving and reliability of transportation have had (and can have much more) major beneficial effects in the organization of production and distribution, and in savings in inventories.

## ECONOMIC DEVELOPMENT AND INTERCITY PASSENGER TRANSPORT

The literature on economic development and intercity passenger transportation is much scarcer than that on economic development, and on transportation in general. The Royal Commission has contracted for a study of the income and price elasticities of the demand for passenger transportation, one of the main concerns under this heading. Accordingly, the elasticities will be reported on here rather cursorily.

It is clear that there are two-way causations between economic development and intercity passenger transportation. Such developments as jet passenger aircraft and paved roads have caused developments in intercity passenger transportation. Looking at the relationships the other way, increased real household incomes have been a cause of the enormous increases in the ownership and use of private cars, in both intra-city and intercity passenger transportation.

Recent literature that addresses the subject includes Gillen and Oum (1981); Grubel and Walker (1989); *Mathematica* (ed.) (1966 and 1967); McRae, (January 1989); Morrison and Winston (1989); Oum and Tretheway (1988); Oum, Waters and Yong (1990); Palmer (1988); Salvas-Bronsard and Bastien (1984); Scarfe and Krantz (1988); Transport Canada (1982, 1988a, 1988b and 1989); VIA Rail (1989); and Watson (1988). The classic literature on consumer demand and the analysis of family budgets will be left to the Royal Commission's study of elasticities (such as the works of Houthakker and Taylor, and of Prais and Houthakker).

In the Royal Commission's Interim Report, the distinction is made between business and personal intercity passenger transportation.

## Intercity Business Travel

Consider business travel first. Among the important points made in the *Interim Report* and other literat[illegible]n this subject are the following:

- For business travel, a useful distinction is the one between travel that involves providing business services, and travel that involves other aspects of the production and distribution of goods and services.
- As Grubel and Walker (1989) show, business services account for about half of overall service economies. Also, these services have been a major factor in the rapid growth of the service economy in North America. These services make intense uses of the transportation of people and communications.
- Business travel places a premium on speed and reliability. For short-distance intercity business travel, the car is clearly the preferred mode. For medium-distance as well as long-distance business travel, air service is clearly the preferred mode. The ability to work while travelling is important, thus the rapid growth of working facilities on aircraft and phone service in cars is understandable. The saving of time is also important. Thus, for business travel, congestion is highly undesirable, particularly when getting to and using air services (Winston, 1991).
- Though price is a consideration for business travel, it is by no means the dominant consideration. The ability to obtain and adjust service quickly, and the considerations just noted, appear to be dominant. Thus, airlines have found it attractive to charge higher prices for business than for personal air service, as well as to provide better facilities.
- For business travel, complements to air service, such as airport hotels, hospitality services and airport car rentals have developed rapidly during the post-World War II period.
- During the post-World War II period, the big loser as a mode for business travel was rail passenger service.
- With improvements in service and reductions in costs, business communications are becoming a substitute for some business travel. Nonetheless, there are still some strong complementary relations between communications and business travel.

**Personal Intercity Travel**

The Royal Commission's preliminary work and a quick scan of the literature reveals the following points:

- Personal intercity travel is dominated by the use of personal cars for short- and medium-distance voyages. The personal use of air services is growing rapidly, particularly for long-distance voyages. Long-distance personal voyages are also growing rapidly. Train and bus services appear to be losing shares in passenger transportation.
- The spread of personal ownership and use of cars, first in America, then in Europe and Japan, has brought about one of the greatest social changes of modern times. Intercity personal travel is no longer the preserve of the rich. People of almost any age and economic standing can go almost anywhere they want, with privacy, comfort, convenience and economy. People will not readily give up their personal ownership and use of a car for a bus or train (or, in cities, for urban rapid transit). This applies more in North America, with its vast distances and low population densities, than it does in Europe or Japan. But the car, even in Europe and Japan, has a remarkably large share of the intercity transportation market.
- Car and air services are commonly labelled "superior goods," in the economists' sense of that term. The contention is that, other things being equal, increases in demand for these services will outpace increases in income. Bus service has been labelled an "inferior good" (Palmer, 1988) meaning increases in demand for bus services will not keep up with increases in income. Evidently, intercity common carrier buses are now used mainly by the young, the poor and the elderly. Palmer argues that rail passenger service in Canada is still a superior good.
- These income elasticities are important distinctions, for they provide some indication of the relative growth in the demand for various intercity passenger services as the incomes of Canadians change. The evidence, however, has to be analyzed carefully. Firstly, the demand for passenger service per household could decline or increase slowly in comparison with the increase in household income; yet the overall demand for the service could increase much more rapidly because of the increase in the numbers of households. Secondly, other factors affecting demand change over time. Quality of services may be altered by supply factors. The relative prices of the services may be changed (for example, the energy price

cycles of the last two decades affected modes of passenger transportation differently). Policies may change regarding the structure and system for imposing charges for the use of public facilities. The distribution of income and wealth may alter; personal transportation preferences may differ among income classes. Thirdly, one set of observations may arise from depressed economic conditions and another from boom economic conditions.

Industry analysts predict that intercity passenger transportation in North America will remain dominated by the private car and the aircraft during the next two decades (Johnson in U.S. Department of Transportation, 1989; U.S. Congress, Joint Economic Committee, 1989). With the application of new materials, such as composites and ceramics, and changes in design of engines (perhaps with the use of alternative fuels), the supply capabilities (quantity, quality and cost) of both cars and aircraft are expected to continue to improve. These expectations reinforce the conventional wisdom that cars and aircraft will dominate the next two decades of intercity passenger transportation.

However, these "status quo forecasts," as Fuller calls them, may be challenged by radical changes in environmental regulations, fuel prices, and other considerations.

One key question is whether high-speed intercity rail services could become economical substitutes for car and air services. Others will have to answer that question for Canada. In my view, Hickling's *Primer* should be applied to such issues, just as it should to highways and airports. The Hurley and Jones Discussion Paper (1990) indicates that substantial capital subsidies would be required to support high-speed intercity rail service in the Montreal–Ottawa–Toronto corridor, to say nothing of the Quebec–Montreal and the Toronto–Windsor links. Press reports of the Ontario-Quebec Task Force and of the Bombardier and Asea Brown Boveri proposals appear to call for substantial subsidies. Whether such subsidies would be justified to bring the social benefits into line with the social costs of such services, I cannot answer, for lack of data.

For conventional rail passenger service, Cubukgil and Soberman (1986) argue that subsidies would not be needed in the Quebec–Windsor corridor. They maintain that VIA Rail could operate in this corridor without them if three conditions were met: (1) excessive charges by the railroads for their services could be eliminated; (2) feather-bedding practices of VIA Rail's workers could be cut way back; and (3) VIA Rail's excessive administrative overhead could be reduced.

## EFFICIENT TRANSPORTATION INFRASTRUCTURE INVESTMENT AND PRICING POLICY

The main ideas of the theory of efficient transportation infrastructure policy were first worked out more than 70 years ago (See Pigou, 1918; Knight, 1924; and Mohring and Harwitz, 1962.) These ideas, however, remained more or less just academic musings for many years, even among economists. Recently, a tremendous amount of interest in the subject has arisen. One reason for this is that newer technology, particularly the application of microelectronics, appears to make efficient user-charge systems practical. Another has been new evidence (both data and quantitative analysis) that shows the inefficiencies of certain systems, particularly highways and airports. A third reason for the current interest in transportation infrastructure policy is the enormous estimate of the costs to maintain, restore and add to the infrastructure. This has given a renewed sense of urgency toward improving the efficiency of the system.

The literature, in addition to the classics noted above, includes: Bos (1985); Downs (1962); Bird (1976); Brander et al. (1988); Gillen et al. (1988); Hickling (1990); Oum et al. (1990); U.S. Department of Transportation (1989); Morrison and Winston (May 1990); Schultze (1990); Small et al. (1989); and Winston (1985 and 1991). The best survey of the literature is in Winston (1985), and the most compact recent application to highways and airports is in Winston (1991). As already noted, the most severe critique of the practicality of the economic efficiency advocates is by Altshuler, in Munnell (ed.) (1990).

Altshuler's central idea is to invest more efficiently in infrastructure (highways and airports appear to have received the most attention), and to then charge appropriate prices for its use.

Consider highways, for example. Two sets of problems arise, one concerning trucks and the other concerning cars and their equivalents. Trucks are the primary cause of the deterioration, and need for highway repair, resurfacing and reconstruction. The deterioration is primarily a function of the thickness and quality of the pavement (road surface), and the axle-loading of the trucks. According to Small et al. and Winston (1991), current engineering standards do not demand thick enough and strong enough pavements. A program for upgrading pavements and charging trucks for their use (based on axle-loadings) could lead to substantial improvements in the long-run efficiency of the highway system.

Cars and their equivalents, not trucks or buses, are the main cause of highway congestion. To alleviate this, congestion pricing could be introduced as part of the regulations governing the use and financing of highways. This now appears to be technically feasible, and practical. Small et al. (1989) and Winston (1991) report on a number of successful experiments in congestion pricing.

Winston (1985) surveys the work on time and price elasticities in transportation, and indicates their importance in determining appropriate congestion pricing. These user- and congestion-charges would be in addition to gasoline and other fuel taxes, with overall revenue to cover the costs of building and maintaining the highway system. As a transition measure, some use of general revenue or borrowed funds would be required.

### Highways

Winston (1991) sums up the highway case as follows:

> Efficient highway infrastructure policy is designed to make the best use of scarce durability and capacity. Scarce durability arises because roads can only withstand a finite number of standard loadings before they need resurfacing. Efficient road wear pricing attempts to reduce loadings by forcing shifts to trucks with fewer loadings; efficient investment recommends road design that allows roads efficiently to withstand a greater number of loadings. Each policy extends road life and saves society maintenance expenses; together they reduce maintenance expenses even more and, most importantly, they minimize redistribution and thus political problems. Scarce capacity is effectively rationed by congestion pricing; such capacity only can be used by those motorists willing to pay an efficient premium for it. With efficient highway infrastructure policy in place, authorities are able to make efficient decisions about whether building new roads can be economically justified. (p. 122)

Winston's argument is set out more fully in Small et al. (1989), and congestion-pricing arguments are supported in varying levels of detail in Downs (1962); Hickling (1990); Johnson, in U.S. Department of Transportation (1989); Schultze (1990); and Small, Winston and Evans (1989). Though the economic efficiency arguments regarding highways are logically sound and supported by evidence, Altshuler regards congestion pricing in the United States as unacceptable for political reasons.

### Airports

Similar efficiency arguments are being applied to airports, where the problem is mainly congestion. Winston (1991) writes:

> Optimal airport pricing and investment policy could generate roughly $11 billion (1988 dollars) in annual benefits. Travellers [would] reap $8 billion in reduced delay and also would pay lower fares because the expansion in runway capacity called for under optimal investment combined with congestion pricing would reduce congestion to such an extent that, on average, landing fees would fall. The annualized cost of the additional runway investment is only about $1.5 billion. Carriers benefit from the lower operating costs from reduced delay. Airports' net revenue would fall slightly, but, as we argue below, they would become financially self-sufficient. . . . Combining efficient pricing and investment would postpone the need to build expensive new airports. . . . Continued growth in air travel will eventually necessitate constructing new airports, but these decisions will be made more efficiently if we make better use of our current airport capacity. (pp. 123–24)

Gillen (1988) has published an elegant and technically persuasive paper on the application of airport pricing principles to Canadian airports. In particular, the paper presents the case for peak and off-peak pricing, for differentiation among types of user, and for combinations of marginal-cost pricing and demand elements in efficient pricing systems. Hickling (1990); Morrison (1983); Morrison and Winston (1989); and Morrison and Winston (1990) also present strong cases for efficient investment and pricing of airport use.

Altshuler (1990) is more optimistic about the applicability of economic efficiency principles to airport congestion than to highway congestion. Even so, he believes that public concerns over noise and environmental considerations will outweigh much of the economic efficiency argument regarding investment in airports.

Bird (1976) presents a good case for more widespread application of user-charges on public facilities in Canada. Gramlich (1990) presents the current public finance view of the application of user-charges for public goods in the United States. Much of what he suggests would be suitable in Canada.

The efficiency literature also provides evidence as to whether there is over- or under-investment in such infrastructure as roads and airports. *It strongly supports the view that the investment has been excessive*, in the sense that if the capital stock were efficient, it could provide additional and more efficient services. Paradoxically, additional investment would be required in the short-run to improve the durability of roads, install congestion pricing systems, build more airport runways, and improve traffic control facilities. But, argue the advocates, less investment would be required over the long-run, and self-sustaining financial arrangements could be operated for roads and airports.

## TRENDS AND PROSPECTS FOR TRANSPORTATION NEEDS

In this literature review, no attempt is made to canvas the forecasts thoroughly. The Royal Commission has other work under way on trends and prospects. Some incidental literature on these matters was encountered, however, and is reported on here.

Since many Canadian trends follow those in the United States, we begin with a review of those trends. We then make a few Canada-U.S. comparisons, and speculate a little on Canadian trends and prospects for transportation needs.

The U.S. literature upon which comments are made includes: U.S. Department of Transport (1989); U.S. Congress, Joint Economic Committee (1989); U.S. National Research Council, Transportation Research Board, *A Look Ahead, Year 2020*, and particularly an article by Lewis, Hara and Revis: "The Role of Public Infrastructure in the 21st Century"; Eno Foundation, *Transportation in America* (May 1990); and comments by Gail D. Fosler, in Munnell (ed.) (1990).

## Demographic Trends

A good starting point is the section of the overview paper by Fuller, in *Moving America*, that deals with Johnson's paper, "Transportation for the Next Century." Fuller's paper concentrates on demographic trends as they will affect transportation, but on a more detailed basis than the Royal Commission did in its Interim Report. Fuller writes: "The cumulative impact of demographic change suggests the following conditions for the United States in the future:

- slower economic growth and relatively less total demand for new transport investment;
- a service-oriented economy with relatively less demand for freight movement;
- a premium on service in which transport speed, safety, and reliability all feature;
- problems in finding an adequate labour force for transportation;
- more demand for leisure travel;
- major highway transport demand in suburban areas of the West and South;
- more flexibility in work schedules; and
- a greater consumer premium on time and convenience in transport, making America an 'impatient society'." (p. 7)

Growth in transportation demands in the U.S. is expected to be slower in the future than in the last few decades, largely because of demographic factors. Some continued growth in demand is expected. The population is still increasing overall, and growth in the Southern and Western regions is rapid. Increases in income are expected to continue, and to eventually overtake increases in expenditures on transportation. Car and air travel are forecasted to be the preferred modes in transportation growth. The combination of that growth, the demands for better service and the economic burden of improved transportation services has increased the pressure for improved operating efficiency.

Based on Johnson's paper, Fuller contends that improvements in the operating efficiency of the transportation system are not only important, but feasible. He is more optimistic than Altshuler (1990). Fuller writes:

> Operating efficiency means higher speed and improved service quality, particularly involving transport nodes, or hubs. Johnson suggests that four developments are needed to achieve efficiencies: (1) understandable service goals and measures of goal achievement, (2) *market-oriented strategies and pricing for solving transport problems* [emphasis mine], (3) new funding methods, and (4) information tools to enhance transport performance. There is special promise in applying computers to existing transportation systems; the opportunities for applying bold new technologies, however, are very limited. (p. 7)

Disagreements about the extent to which market-oriented approaches to transportation services should be adopted have been encountered already in this survey. In *Look Ahead, Year 2020,* Lewis et al. make strong arguments for increased use of user-fees for transportation services, but not exclusively user-fees. Fosler (1990) accepts the contention that rate-of-return and efficiency considerations, and privatization, may point toward increased efficiency in infrastructure investment and operations. In her judgement, however, ". . . infrastructure spending . . . will have to rise substantially; and it will have to rise in areas in which neither the economics nor the political process will favour private solutions." (p. 182)

Any long-run economic forecasts risk paying too much attention to some forces and not enough to others; or of not foreseeing changes that may become important. Fuller queries Johnson's orthodox forecasts. Will environmental and energy difficulties alter transportation demands or the way in which they have to be met? Will the application of computers to transportation be extensive and efficient? Some queries from other literature include: Will the Southern and Western United States be able to cope with water shortages that could limit their growth? Will the suburbanization and diffusion of the location of economic activities continue? Will society cope effectively with the transportation needs of the elderly and persons with disabilities? Will high-speed, guided ground transport in major intercity corridors be intensively developed in North America, and, if so, will this succeed in displacing much of car and air travel?

When comparisons are made of the current situation and recent trends in passenger transportation in Canada and the United States, several similarities and differences stand out (see *Transportation in America,* May 1990; *Getting There: Interim Report of the Royal Commission on National Passenger Transportation*, 1991; Bothwell, Drummond and English, *Canada Since 1945*, revised edition, 1989.)

The post-World War II growth and age-structure of the two populations are similar, except that the rate of growth, relative levels of immigration and size and duration of the Baby Boom were larger in Canada.

The aging of the populations is similar, except that changes in Canada lag behind those in the United States. The enormous increase in female participation in the labour force has been similar too, though to a slightly greater degree in the United States. In both countries, use of private cars and air travel have become the preferred modes of intercity travel since 1945. Levels of car ownership are now high in both countries, but more so in the United States than in Canada. Similarly, use of air travel is greater in the United States. Due to the aging of the populations, growth of intercity travel is expected to slow in both countries; but income, demand, and technological changes suggest that some growth in intercity passenger transportation is likely in both. There is likely more potential for such growth in Canada than in the United States.

Canada does not have a sunbelt comparable with the one in the United States. It acts as a catalyst for population growth, and people travelling in this area rely on cars, small trucks and aircraft for transportation. Urban and suburban trends in Canada are largely based on car transportation, and it is difficult to envisage this changing during the next two to three decades. Trends toward a service-oriented economy, a premium on speed, safety and reliability in transportation, two- and three-worker households in which each person depends on his or her car, increases in leisure travel, and a predicted scarcity of young people — all these are qualitatively similar in Canada and the United States. The transformation of air service to hub-and-spoke patterns is also common to both countries.

Among the differences, proportionately more people and activities in Canada are located in areas with cold, harsh winters. Highway deterioration from weather is thus a bigger problem in Canada. Canadian tourist travel to the United States is proportionately larger than that of Americans to Canada (and absolutely larger, too).

## SOME TENTATIVE CONCLUSIONS ON TRANSPORTATION AND ECONOMIC DEVELOPMENT, WITH SPECIAL EMPHASIS ON PASSENGER TRANSPORTATION

The conclusions to this survey are presented in two parts. The first is an overview of the evidence on transportation (in general, and passenger in particular) and economic development. The second is a recall of the more startling and outrageous recommendations for policy changes in transportation and economic development.

### Overview of Evidence on Transportation and Economic Development

Both for transportation in general and for passenger transportation in particular, a vast and varied literature supports the contention that transportation has been a major contributor to economic development. Common observation provides a worthwhile body of supporting evidence, but there is much more. Historical and econometric analyses point to these conclusions. Much systematic evidence has been developed at macroeconomic levels, and for regions and sectors. Rigorous methods and useful standards have been applied to thousands of individual projects and proposals. Some reconciliation of engineering and economic methodologies has taken place. Despite the criticisms and calls for reform in policy regarding transportation and economic development, the conclusion set out above appears to be warranted.

The evidence suggests that transportation investment and maintenance will be worthwhile contributors to economic growth in developed countries in the future. However, those contributions do not seem likely to be of overwhelming importance on the scale of the railroad and steamship in the 19th century, or of the car, truck, highway and airplane in the 20th century.

The issue of *improved economic efficiency* in the investment and operation of transportation is raised in much of the literature, and many suggestions are made on how to reach that objective. These include congestion pricing or taxation; increased use and redesign of user-charge systems; and substitution of privatized for public services. More rigorous and careful application of economic benefit-cost measures are suggested, along with integration of the economic and engineering criteria for decisions on transportation. Still, the economists' zeal for *economic efficiency* continues to be ignored by many, and vigorously challenged by others.

The so-called "public good" arguments for government involvement in transportation (as owners, operators, financiers, subsidizers and regulators) appear to be less applicable and more selective than they were in the past. Natural monopoly elements, where they continue to exist, are subject to more competition. Changes in technology have made externalities that could not be charged to users in the past, now chargeable and collectible. The inefficiencies of governments weigh more heavily in public choice than before. Public concerns still arise in transportation services, and some have become more important (for example, environmental protection).

Speed and reliability of service are of increasing concern in transportation, but they appear to be largely determined by private decisions.

### Contentious Analytical and Policy Views in the Literature

Early on in this survey, a number of contentious analytical and policy views were flagged. What follows is a summary of some of the evidence for these views.

First, many writers suggest that the United States and Canada have mixes of transportation facilities and services that are inappropriate because they are out of keeping with current technology, demands, and cost opportunities. As an example of this, see Friedlaender's and Walters' judgements (in Munnell (ed.), 1990) concerning the gross over-building of roads in many rural U.S. areas, as well as the over-building of rapid-transit systems to and from city centres.

Hickling shows that too little attention is paid to net economic benefits in decisions about the amount and kinds of transportation projects. Hickling also notes that misleading technical, local and regional criteria are widely used in decision-making models, particularly by state and local governments. Projects have been built that have little value. Projects with net economic value have not been undertaken because their measurement was not done correctly.

Small et al. and Winston provide convincing evidence that the design of highways (particularly the thickness and durability of pavements) is inadequate, and that the number of runways at airports is also inadequate.

Downs and Schultze argue convincingly that if transportation facilities are provided to the public at a zero or near-zero private marginal user-charge, then projects aimed at reducing congestion will inevitably cause more usage and more congestion.

A second startling contention in the literature is that facilities, even when they are appropriate, are used inefficiently. Schultze, Winston and Small et al. show convincingly that, for highways, there are inappropriate user-charges for trucks, and an absence of appropriate congestion charges for all types of users. Recently, other literature has supported instituting user-charges. For example, both Tobin and Blinder, in their testimony to the U.S. Congress Joint Economic Committee (1989), urged much greater application of user-charges to infrastructure. Hickling's discussion of the base case against which new projects should be compared is notable in this connection. Similar arguments were developed by Adler, in Fromm (ed.) (1965).

In the literature, a third startling and repeated contention is that the counting of benefits and costs of transportation is frequently inappropriate. Hickling argues that too little attention has been given to benefits such as time-saving, reliability, user-costs, vehicle damage, and safety, so that benefits are frequently under- estimated. Small et al. and Winston argue the same point.

Hickling argues that too little weight is given to the benefits arising from improved efficiency in the production and distribution of goods (such as just-in-time logistics of production and enormous economizing on inventories at all levels of production and distribution). This point is strongly reinforced by Quarmby (1989). Pollution Probe, Suzuki and others argue another case, that gross under-estimates have been made of the costs of environmental degradation caused by transportation practices. Fourthly, it was noted earlier in this survey that there were strong views in the literature that the United States and Canada have too little infrastructure, particularly transportation infrastructure. There were equally strong views that the bias was toward too much investment in infrastructure.

Evidence for there being *too little investment in infrastructure, and transportation in particular,* includes the following:

- the Aschauer et al. macroeconomic studies of the high productivity of infrastructure, a productivity that is alleged to be much above the returns on other investment, and by implication above the social opportunity cost of capital;

- the widely held view, among both engineers and economists, that investment in infrastructure during the last two decades has been reduced, and that it has not been sufficient to maintain the real stock of that capital;
- the carefully measured judgement of such transportation economics experts as Mohring and Harwitz about the strong tendency to under-estimate the benefits of highway projects;
- Hickling's illustrations of possible projects for which the benefits appear to clearly exceed the costs;
- Hickling's evidence on widespread under-estimation of benefits, particularly of highway and airport projects; and
- Hickling's contention that too high a hurdle rate (social opportunity cost of capital) is used to evaluate transportation projects.

Evidence for there being a bias toward *over-investment in infrastructure* includes:

- the convincing evidence of Small et al. and Winston that large inefficiencies in transportation infrastructure could be overcome by an initial investment to upgrade the systems, together with user-charges;
- the widespread tendency, noted by Adler and Hickling, to count as benefits things that are not benefits (such as employment), and to double-count benefits (transportation savings plus increments to land values); and
- the extensive window-dressing of benefits that is found in the decisions and evaluations of most state and local infrastructure projects.

My inclination, after reviewing this evidence, is to refute the extremes of criticism as well as the promises of benefits from reforms. Undoubtedly, there have been major mistakes in transportation planning and undertakings. The over-building of railway lines in Western Canada early in this century, and of Mirabel airport in the second half of this century, are examples that come to mind. But every line of public and private venture contains successes and failures. The question is whether the mistakes in transportation are the exception rather than the rule. Canada and the United States could not have had as successful a half-century of economic growth as they have had since the end of World War II if their transportation investments and operations were failures, or, at least, gross errors.

I am inclined to accept the arguments about the benefits of increased application of user-charges and earmarked taxes in transportation. New opportunities have arisen from new technologies. While not as pessimistic as Altshuler about their acceptability, I believe that there will be a good deal of inertia in extending user-charges in transportation. Furthermore, the efficiency improvements are not likely to be as large as Winston, Schultze and Small maintain.

I am more inclined to accept the Aaron, Schultze, Winston, and Musgrave judgement on the size of the economic returns to infrastructure investment than I am to accept the Aschauer judgement. But the line of analysis opened up by Aschauer, and explored by many others, has added to the evidence on the role of infrastructure on the economy as a whole, and on regions and sectors.

I acknowledge that a good deal of fakery, puffery, and wrongheadedness exists in the analysis and decision making on investment and management of infrastructure, including transportation. But a good deal of weight should be given to the other side of this argument. Much more careful and reliable benefit-cost analysis is done in these areas than was carried out 20 or 40 years ago. Computer-based analysis and information bases have enormously improved these aids to decision making. A highly trained and experienced profession of planners and evaluators has developed as a result.

# PART B

# TRANSPORTATION AND REGIONAL ECONOMIC DEVELOPMENT (WITH SPECIAL EMPHASIS ON PASSENGER TRANSPORTATION)

## QUESTIONS AND CONCEPTS

In this part of the survey, the main issues are:

- Has transportation shaped the *regional pattern* of Canadian economic development?

- Has passenger transportation shaped the *regional pattern* of Canadian economic development? In what ways? Have the transportation activities been beneficial? Where they have not been fully effective, why not?
- Are transportation (particularly passenger transportation) projects and policies effective ways for improving the overall and regional features of Canadian economic development?
- What are the interactions between transportation and other factors affecting the regional features of Canadian economic development?
- While the interests in this survey are ultimately Canadian, much of the literature is based on U.S. experience. Because of similarities in economic history and geography, however, that literature provides lessons for Canada.

A pragmatic approach to the concept of "regions" seems best for this survey. The regions that are considered to be affected or affectable by transportation developments are: metropolises and their satellites; secondary cities; "heartlands" and "hinterlands," as geographers call them; provinces; and regions within provinces and states, singly or in groupings. The main concern of this survey is inter-regional, but the structure of modern economies requires consideration of intra- as well as inter-regional developments and the relationships between them.

## TRENDS OF REGIONAL ECONOMIC DEVELOPMENT IN CANADA AND THE UNITED STATES

What have been the main regional patterns of Canadian and American economic development during the last half-century? Superficially, how have changes in transportation affected them? How have the patterns of economic development affected transportation?

## CONSIDER CANADA FIRST

While the production and distribution of resource-based export staple commodities have become smaller shares of Canadian GDP than they were five and ten decades ago, they are still important activities. For the agricultural, fishing, forestry and mineral products industries (oil, gas and derivatives), transportation continues to be a major factor. It is required mainly for the movement of commodities, although passengers who service these staple industries also require transportation. Location of extraction and processing activities continues to be mainly at the resource base, and these bases are spread across the country. Thus, Canada's resource industries and its transportation shape many of the country's regions. The decline of the share of the work force involved in agriculture has been particularly dramatic.

Secondary manufacturing increased and then fell back as a share of Canadian GDP, but continues to be a major group of activities. To a surprising degree, these industries are centred in the major metropolitan areas — particularly in and around Toronto and Montreal. Within these urban areas, manufacturing has moved from the city centres to the suburbs and satellite cities. (See the *Historical Atlas of Canada,* Volume III, Plates 7, 12, 13, 14, 51, 54, and 55.) While transportation costs do not appear to be as critical for the location or productivity of secondary manufacturing as they used to be, they are still important. Moreover, speed and reliability of transportation services have become more important for many secondary manufacturing industries.

### Service Industries

The largest recent change in the structure of the Canadian economy, aside from the decrease in the agricultural work force, has been the growth of service industries. Aside from rural recreational activities, the bulk of service activities have located in and around metropolises. This is not surprising in view of the Grubel and Walker (1989) evidence that about half of service activities are business services of one kind or another. Transportation of people and interpersonal communications are major causes of the development of these parts of the service economy.

Health care and education have grown more rapidly than the GDP and the work force; these too are predominately located in and around metropolises. School consolidation and busing have increased the urban concentration of elementary and high school education.

The enormous increase in the participation of women in the labour force has affected the structure of the economy and has interacted with transportation. It has:

- intensified growth in ownership and use of private cars;
- intensified the substitution of household equipment for household labour; and
- been a catalyst for the rapid growth of fast-food outlets and commercial consumer services.

**Regions**

Cities outside the Canadian heartland have become ambitious to diversify their activities and outgrow regional servicing functions.

Despite a huge increase in productivity for the Canadian economy as a whole, poor and low-productivity regions persist. Newfoundland, much of the Maritime provinces, and parts of rural Quebec appear to not have improved their comparatively low productivity, slow growth, high unemployment and under-employment in relation to the Quebec-Ontario heartland, Alberta and British Columbia.

Regions in which Aboriginal peoples live continue to have notoriously poor economic performance, with a few exceptions. Even within prosperous provinces, pockets of poverty, some of which have a regional dimension, persist. Examples of these are areas in which declining manufacturing industries predominate, and areas in which the primary resource is declining.

The United States is witnessing many of these trends as well, and is seeing some significantly different trends, including:

- a movement of people to the sunbelt;
- a decline in numbers of unionized workers;
- industrial decline in the Great Lakes and midwestern regions; and
- a large and persistent illegal immigrant problem.

## HAVE TRANSPORTATION ELEMENTS BEEN MAJOR FORCES SHAPING THE REGIONAL AND INTER-REGIONAL STRUCTURE OF THE CANADIAN AND UNITED STATES ECONOMIES?

### Conflicting Opinions

Transportation gets mixed reviews in both countries with respect to regional economic development. Some writers attribute the economic development of a region to favourable transportation developments. Canadian examples of this include:

- the post-World War II highway links between central Canada and the U.S. interstate highway system that are largely responsible for the continental integration of the Canadian and U.S. manufacturing economies;
- the development of oil and gas pipeline networks and the post-World War II development of Alberta and Saskatchewan oil and gas resources; and
- the Quebec North Shore and Labrador Railway and the post-World War II development of the Labrador Trough.

Many writers attribute unsatisfactory regional economic development, in part, to inadequacies or mistakes in transportation developments and policies (for example the reduction in subsidization of Maritimes freight rates).

Some writers contend that transportation developments or policies could be the main force to improve the economic welfare of less-well-off regions. These regional transportation proposals are sometimes thought to be consistent with increased national GDP. Sometimes they are acknowledged to be mainly diversionary, but are advocated nevertheless. It is frequently contended that most regional transportation projects merely shift activity from one region to another, thereby *reducing* real national output. This view is given much weight by Adler, in Fromm (ed.) (1965); and by Hirschman (1958). Much of Hickling's *Primer* aims to prevent such outcomes.

It is important to recognize, nevertheless, that many transportation developments that improve national economic development necessarily have favourable effects on many regions. If investment in better pavements for highways greatly improves the efficiency of their use, it is likely that these same improvements will benefit most regions; trucking, after all, is ubiquitous throughout Canada. If improved air traffic control technology would improve the national efficiency of air service, it is likely to do so in most regions, though not necessarily to the same degree. If real incomes produced or received increase in most regions, even though relative gaps are changed little, the demand for some kinds of transportation services will increase in most regions, though again, not necessarily to the same degree.

Thus, the issues of transportation and regional development have to be appropriately formulated. For example:

- Are national trends in transportation causing national economic development to be applied appropriately in various regions?
- Are some trends in transportation more effective for some regions than for others, and do the projects and policies reflect this?
- Do some problems in transportation, such as congestion, occur everywhere, although more severely in some regions than in others?
- Is transportation a more suitable agent of economic development in some regions than in others?

## LITERATURE TO BE SURVEYED

The literature to be surveyed includes:

On regional development theory and policy: Adler, in Fromm (ed.) (1965); Eberts (1991); Fox (1990); Green (1971); Isard (1975); Kraft et al. (1971); McCann (1987); Norrie and Percy (1988); Savoie (1981 and 1986); Sitwell and Seifried (1984); Studnicki-Gizbert (1990); Sullivan et al. (1989); Vernon (1969); and Munnell (1990b).

On empirical regional and transportation literature: Deno (1988); Eberts (1991); Fox (1990); Friedlaender (1990); and Munnell (1990a).

## THEMES IN THE LITERATURE

Among the literature on transportation and regional development, several themes appear repeatedly. The same concepts and measurements apply regionally as they do nationally for deciding on and evaluating transportation and economic development. Transportation projects are rarely the main determinant of location or productivity of activities in a region. Except for resource industries, they are generally one element interacting with many other elements in determining regional economic development. If many other elements are not favourable to economic development in a region, a major transportation investment is not likely to be worth the cost.

The integration of transportation projects and policies and other regional economic development policies has seldom been done effectively. Indeed, in recent books on regional economics, it is surprising how little attention is given to transportation. In Savoie (1986), for example, there are three minor comments on transportation.

## SOME DETAILS FOR VARIOUS KINDS OF REGIONS

Any consideration of transportation and economic development should deal with such diverse regions and inter-regional relationships as were noted above. They should deal both with regions with high employment, productivity and growth, and with those with low employment, productivity and growth. Consideration of regionalism and economic development should not be confined to the so-called "have-not" regions and the "poverty pockets."

During the 1950s and 1960s, the literature on economic development paid considerable attention to public investment and social overhead capital. Hirschman (1958) notes the political and social pressures in both developing and developed countries to scatter public investment over all regions in a country. Often the national economic development results were poor. Fox (1990) remarks on the limited empirical evidence that exists on the regional effects of infrastructure developments and policy, despite Hirschman's early interest in the subject.

Fox writes:

> Application of research results to improve policy requires understanding how the productivity of infrastructure varies at different locations, and why. Presumably, a given marginal infrastructure investment shifts the production frontier out by different amounts across regions. Further, actual production may not respond to a shift in the frontier,

> particularly if the economy was already operating inside the previous frontier. However, little empirical evidence exists on how productivity effects vary by region, despite longstanding conceptual arguments that considerable difference should be expected (for example, see Hirschman, 1958) and it is difficult to generalize the findings of what research exists. The lack of good guidelines on infrastructure's productivity in different geographic and economic environments is perhaps the most troublesome limitation imposed by the current base of empirical knowledge. (p. 32)

In reviewing transportation and regional development, this paper examines:

- large, mature, well-off regions;
- hinterlands, between-hinterlands and export markets;
- hinterland cities seeking diversification;
- passenger movements in diverse regions;
- have-not and have-less regions; and
- Canadian programs and regional inequalities.

In large, mature, well-off regions, transportation is one element of integrated development processes. Such regions generally have a well-developed transportation system with a high density of roads, railroads, and airport facilities. Kraft et al. (1971) make note of this when they remark that:

> - On the whole, transport will not greatly influence the shape of future regional development in the United States, although under certain circumstances it may help a region to capture a fair share of decentralizing industry. In this respect, service considerations more than costs may determine the attractiveness of a particular transportation network.
> - The diminishing role of transportation in influencing location choices should not be too surprising in a country where the network is very extensive already. (p. 35)

Similar conclusions apply to Canada now, although the Trans-Canada Highway network is less developed than the Interstate Highway System in the United States. Transportation will have to adapt to changing demands, growth and technology.

As discussed in the general treatment of transportation and economic development, Western industrialized countries have, for decades, concentrated their economic activity in and around cities. These concentrations, however, differ in their degree of specialization. Porter (1990) emphasizes the clustering of related firms in certain cities.

Axiomatically, better-off regions have the wealth and income to maintain and improve transportation. However, judging by the pleas of U.S. governors for federal funds and for tax-exempt status for transportation bonds, the willingness of even the better-off states to be self-sustaining in infrastructure investment and maintenance is limited. (See U.S. Governors' Task Force Report, 1989; and Gramlich in Munnell (ed.), 1990.)

Economic development can be largely a self-sustaining process, although in the past it has depended on certain public goods, such as education, transportation and communications, and research and development.

Whether public policies on transportation and economic development should focus on increasing infrastructure, or improving its efficiency of design and use, or some mixture, is a moot point. The governors (1989) and many economists (Galbraith, 1991; Joint Economic Committee hearings, 1990) emphasize increased investment. As shown in Part A of this survey, the Congressional Budget Office, Schultze, Small and Winston emphasize improving the efficiency of investment and use. These arguments are being fought for in every better-off region in the United States. The situation in Canada is unclear, although highway authorities and municipal governments in well-off regions are pleading for more provincial and national financing of infrastructure investment.

It appears that the movement of people within and among the more highly developed regions in North America will continue to grow more rapidly than the real output of goods and services of the regions. This inference is drawn from Winston's 1985 survey. Even if much improvement in efficiency in investment and use takes place, eventually some increase in the stock of infrastructure capital (particularly in transportation) will be worthwhile. As Fosler commented in Munnell (ed.) (1990), economic and social pressures will support such increased investment sooner rather than later.

The major transportation problems in the well-off regions of Canada are likely to be congestion and maintenance of the infrastructure.

## TRANSPORTATION AND ECONOMIC DEVELOPMENT IN THE HINTERLAND AND BETWEEN THE HINTERLAND AND EXPORT MARKETS

Transportation is central to staple product production and distribution of hinterland. If a new resource project is proposed in an area not served by transportation, then the development and cost of transportation is an integral part of the decision for the project. Examples of this include the Quebec, North Shore and Labrador Railroad; Pine Point Mine; North-East B.C. Coal; Alberta Pulp and Paper; and Beaufort Sea and Mackenzie Valley oil and gas. If the new resource project is already served by transportation, then the prospects for the project are improved.

Transportation has often led economic development and shaped its regional distribution (see Eberts, 1991; Fogel, 1964; Fox, 1990; Kraft et al., 1971; McCann, 1987; and Sitwell and Seifried, 1984). Canals, waterways, ports, railroads and roads are well-known examples of how this happens in the United States and Canada. More often than not, these transportation developments involved public investment.

The consensus in the literature is that transportation is a necessary but not sufficient condition for the economic development of areas that have not shared fully in the economic development of well-to-do countries. However, even if transportation is necessary, it is usually considered to be an unimportant element in regional development programs. Eberts (1991) writes:

> . . . public infrastructure is more a necessary condition than a sufficient condition for economic development. While public infrastructure construction can provide local jobs, unless the project is of considerable size and ongoing, sufficient demand to sustain local economic development must come from other sources. Still, the question needs to [be] raised, "Would the investment have occurred without the transportation investment?" (p. 7) [He later asks] Does transportation induce economic development? The answer, gleaned from the current body of empirical research is a qualified yes. . . . Furthermore, the positive effects of transportation are seen at both the local and national level. [This remark appears to refer to the literature generated by Aschauer

> et al.] If the effects were observed at only the local level, one would be inclined to ask whether transportation investment, and other infrastructure investment, is simply rearranging a fixed pool of resources, benefiting those regions that have attractive infrastructure investment at the direct expense of other regions. However, the observed national positive effects allays these concerns to some extent. The ability to stimulate economic growth depends on the economic state or development of a region. (pp. 21–22); see also Sullivan (1989.)

### Hinterland Cities

Hinterland cities seek diversification of their economies; they want to be something more than service centres for their hinterlands. Poor or expensive transportation services are alleged by some writers to be a major limitation on such diversification (Studnicki-Gizbert, 1990; and McCann, 1987).

Governments have tried diversifying in ways that avoid transportation becoming a decisive impediment, such as concentrating on high-tech, high-value goods and services, and on intellectual capital. These have been the purpose of the Alberta diversification programs and the federal government's Western Diversification Program.

Residents and governments of the Maritimes and the Prairies have made repeated complaints about transportation impediments to their diversification and their opportunities to penetrate markets in central Canada and the United States.

### Moving People

While much of the attention on transportation and regional economic development has been on the movement of goods, satisfactory services for the movement of people are also essential.

Movements of people arise from migrations, seasonal labour flows, trade, information exchange, management practices, and educational activities.

Land that is unsuitable for agriculture is sometimes the most attractive for cottages, camping and tourism. Familiar examples of this include the Canadian Shield north of Toronto; the Laurentians; the Rockies; and the Manitoba-Ontario-United States border country. Effective transportation services (such as Highway 400 north of Toronto) are essential in these areas.

One of the clearest examples of the impact that transportation has on economic development and movement of people is the highway development in Newfoundland. Newfoundlanders used to rely on boat connections among the outports and between the main centres and the outports; today they rely on cars and trucks. The Trans-Canada Highway in Newfoundland has brought about profound changes in the province's social and economic life.

### The "Have-nots" and the "Have-less" Regions

One of the main concerns of regional development in Canada has been improving the lot of the "have not" and the "have-less" regions.

Even if policies and programs contribute little to or even decrease national product, most highly developed Western nations do not take a *laissez-faire* approach to the people and institutions in their "have-less" regions. Regional aspects of economic development have been of concern in less-developed countries too, and involve economic, political, social and equity considerations (see Bothwell et al., 1989; Courchene, 1981; Economic Council of Canada, 1977 and 1980; Friedman and Alonso, 1964; Green, 1971; Hickling, 1990; Hirschman, 1958; Kraft et al., 1971; Lithwick, 1978; Savoie, 1981 and 1986; Scott, 1978; and Simeon and Robinson, 1990).

It is usually best to first consider equalization transfers to people and governments, and then to consider regional development *per se*, such as projects and policies. This survey is concerned with regional development projects and policies.

### Regional Transportation Policies

Transportation often has important regional development effects, even when it is not integrated into policies and programs that are more commonly called "regional." In Canada, transportation programs and policies of major regional importance have included:

- building railways and roads to serve less-well-off regions, with considerable public investment and subsidy;
- subsidies for transportation services, such as Crow rate, feed grain movements, and Maritime freight rates; and

- development of proposals for region-serving transportation, such as the gas pipeline to Vancouver Island, and the proposed Maritime extension of the gas pipeline from Eastern Canada.

Studnicki-Gizbert (1990) examines the different approaches to subsidies in Canada; he is highly critical of several of the methods used, and points to inappropriate incentives and inefficiencies.

Regional considerations also arise in transportation regulation and deregulation, such as:

- trucking deregulation, in assurance of reliable, economical common-carrier service for remote areas;
- airline deregulation, in proposals for assurance of reliable and economical service for remote areas; and
- branch line closings, in consideration of the adequacy of remaining transportation services.

Substantial national and provincial regional development programs have been implemented since the latter 1950s, many of which are now summarized in the Fall 1990 Canadian Labour Market and Productivity Centre (CLMPC) *Quarterly Labour Market and Productivity Review*. The best reviews are in the books by Donald Savoie, and are listed in the CLMPC article.

These programs, while they had an infrastructure component, did not contain much transportation activity. It may be worthwhile for the Royal Commission to examine some of the Federal programs under Department of Regional Economic Expansion (DREE), Department of Regional and Industrial Expansion (DRIE), and successors, and federal-provincial agreements under these programs, to determine the transportation components, both for goods and for people.

The programs were laden with subsidies to private investment, either to draw in activities from outside the region or to support local initiatives. In recent years, the latter strategy has come into more favour. These Canadian programs have been plagued by local "pork barrelism," and nearly every politician usually promotes, or at least acquiesces to, such activities. Every town in the Maritimes seeks its share of development funds. Sub-regions within well-to-do provinces seek their share too. Growth-pole ideas were badly abused in Canada.

### Reducing Regional Disparities

The conventional wisdom among analysts of Canada's regional policies is that disparities in productivity and produced income have *not* been reduced by such policies. It is agreed, however, that disparities in *received* income have been substantially reduced, mainly due to federal-provincial transfers to provinces and to people, including equalization, Established Programs Financing (EPF), sharing of Canada Assistance Plan (CAP), and the transfers to people through Old Age Security/Guaranteed Income Supplement (OAS/GIS), Unemployment Insurance Commission (UIC), and Canada Pension Plan/Quebec Pension Plan (CPP/QPP). Not all of these programs are regional *per se;* indeed few of them have specific regional considerations built in. However, they have been the main forces in reducing the regional disparities in Canada, with respect to income received by persons and household.

### Movement of People

The improved relative *income-received* position of persons in the have-less regions has been accompanied by increased movement of people in all categories, and therefore has called on improved transportation services. An excellent illustration of this is the greatly increased movement of people within the 100-mile radius around Halifax as compared with one or two decades ago.

## CONCLUSIONS REGARDING TRANSPORTATION AND ECONOMIC DEVELOPMENT

Many transportation and passenger transportation elements that have contributed to national and international economic development have been shared among the regions, though not always equally:

- good, paved highway systems have been developed in centres where there is significant population density, and for connections between these centres;

- private ownership of cars and light trucks has become considerable in all regions;
- reliable rapid air passenger service, and air traffic control is available throughout the country, including remote areas; and
- oil and gas pipelines serve most regions that have significant population density.

On the negative side, all regions have experienced a deterioration in railway passenger services and little improvement in intercity bus services. The one exception is the improvement in commuter train services for Toronto and environs.

## Transportation's Role in Regional Development

Participation in these transportation-economic development changes has led to investment in transportation in many regions. The literature contends that overbuilding of highways in rural areas occurs more often in the U.S. that it does in Canada.

Some region-specific economic developments are dependent on transportation facilities. Other economic developments have been important contributors in the development of multi-purpose transportation facilities. For example, many resource-sector economic developments have been dependent on road, railroad, and air services. As another example, tourism has often been a deciding factor in the decision to turn a local or regional road into a major highway.

In mature, better-off regions, the main transportation problems are congestion and maintenance. Such regions are capable of self-financed transportation developments, with some allowance for spillover.

When it comes to boosting the economic development of less-well-off regions, transportation and general economic development policies have not been well integrated. Transportation projects appear to be decided by authorities that are distinct from and often out of touch with development authorities and *vice versa*. Admittedly, there are some infrastructure components in general programs concerning regional disparities, but the lack of integration is the rule rather than the exception.

Transportation is often thought to be a minor element in general regional development policies. Paradoxically, advocates of transportation developments often, at the same time, allege regional development benefits in support of their projects.

A couple of decades ago, airports were widely touted as being growth poles (for example, Mirabel and Pickering). These expectations have been severely discounted since then.

On balance, the consensus among transportation economists is that there is a bias toward exaggeration in alleging that transportation projects produce regional economic development benefits.

# PART C

# TRANSPORTATION AND TOURISM

## INTRODUCTION

Intercity movements of people can usually be divided into those for business and those for non-business purposes. (There is some overlap, such as travel to conventions.) Non-business purposes are the aggregation of travel for visiting friends and relatives, for pleasure and for personal reasons.

The principal concern in this part of the survey is travel for non-business purposes, which will be called "tourism." The Royal Commission's Interim Report shows that, in 1988, tourism comprised 83 percent of domestic intercity trips. The report also shows that:

- Canadians travel primarily within their own provinces;
- most trips are for short and medium distances;
- international travel is increasing;
- the transportation mode that travellers choose depends on the length of trip. For short trips, cars are used 95% of the time, air almost never, bus about 3% of the time, and rail about 1%. Use of cars falls to 81% for trips between 320 and 800 kilometres in one-way distance, while air jumps into

second place with 12% for such trips. Bus and rail increase their shares to 4% and 3%, respectively. As trip lengths increase further, air's share increases and the shares of the other three modes decrease;

- Canadians travel primarily by car;
- use of a personal vehicle consumes approximately 91 cents of every consumer transportation dollar; and
- air travel is the most popular mode of public transportation. For long trips, Canadians tend to choose air travel. In 1988, 29% of business trips and 3% of pleasure trips were taken by air.

This section of the survey is concerned with the causal links between transportation and an aspect of economic development, tourism.

Here are the critical questions:

- Is there convincing evidence that transportation projects, policies and operations have shaped tourist activities? How? Why? Have the results been relatively efficient?
- Does that evidence indicate important forces of future development of tourism? Which of these forces arise from transportation? Does the evidence point to policy options for current or future decisions?
- Is there convincing evidence of causal links from tourism to transportation projects, problems, policies and decisions?

Transportation developments clearly cause tourism developments, and *vice versa*. The development of large, fast, economical jet passenger aircraft has led to long-distance tourism. Tourism in the Canadian Shield has led to demands for and provision of better access roads. *Precise analysis of these relationships, and in particular of their changes over time, is difficult.*

Particularly important issues for transportation policy are the response of travel (both personal and business) to changes in the elapsed time and cost of trips, and the incomes and characteristics of travellers. (Economists call these measurements "elasticities of demand.")

The literature examined in this survey includes: Bothwell et al. (1989); Gillen and Oum (1981); Grubel and Walker (1989); *Mathematica* (1966 and 1967); McCann (1987); Oum and Gillen (1983); Oum, Waters and Yong (1990); Palmer (1988); Scarfe and Krantz (1988); Watson (1988); and Winston (1985).

## TRANSPORTATION SUPPLY

A number of transportation developments have increased tourism in North America in general, and in Canada in particular. These have included:

- the enormous increase in private car ownership and operation. (Bothwell et al., 1989 show that mass ownership of private cars in Canada occurred *after* World War II);
- the development of a highway system of paved roads. (Even more than the mass ownership of private cars in Canada, this is a post-World War II phenomenon in Canada [Bothwell]. In the United States the most visible indicator of this is the near-completion of the Interstate Highway System by the early 1970s. Canada has its Highway 401 and Trans-Canada Highway from St. John's to Victoria);
- the development across Canada of a network of civilian airports, with navigation and air traffic control services for dense movement of aircraft, by day and night, in all weather. (The nucleus of the system was given impetus from the wartime Commonwealth Air Training Program, as mentioned in the Bothwell and Kilbourn biography of Howe);
- the availability of reliable, fast, large, economical passenger aircraft;
- the availability of cheap motor fuels; and
- the proximity to Canada's main metropolises of the recreational potential of the Canadian Shield. Land that was virtually useless for agriculture is now the home of vast supplies of rivers and lakes, cottages, campsites, ski hills and so on.

## IMPORTANCE OF TOURISM

Though the available data is incomplete, it contains many indicators of the important place that tourism plays in the lives of Canadians. Watson (1988), for example, shows the growing household ownership of recreation equipment, such as vacation homes, camping equipment, boats, snowmobiles, skis, cycles, motorbikes, and adult-sized bicycles (Table 33). Watson also:

- provides summary data on family expenditures on various forms of recreation or recreational equipment . . . [and notes that] consumers' spending on entertainment and recreation increased from 4.0 percent of GNP and 6.3 percent of total personal expenditure in 1961 to 6.0 percent of GNP and 10.1 percent of personal expenditure in 1983. It is not at all surprising, therefore, that most of the items tracked in Table 34 have also increased more rapidly than total personal expenditure, which rose by just over three and a half times (in current dollars) between 1969 and 1984. For instance, spending on vacation homes rose more than fourfold; spending on holiday lodging more than four and a half times; purchases of recreational vehicles more than five times; purchases of bicycles almost five times. . . . (pp. 78–80)

Watson also comments on the growth in the use of national parks, campground activities, national historic parks and provincial parks — another set of indicators of growth in tourism more than in proportion to population and income (Table 36).

The tourism into and out of Canada is large, though still much smaller than the domestic aspect.

## MODES OF TOURING

Modes of transportation for tourism have already been summarized from the Royal Commission's Interim Report: the mode for short and medium trips is personal car, with air travel being of increasing importance for medium- to long-distance trips.

Palmer (1988) provides useful data on passenger trips by bus and rail. Between 1975 and 1985, the trend has been for an absolute decline in intercity common carrier bus trips, but not much decline in comparable rail trips. Palmer argues that, "Regardless of some qualms about these data, it appears that passenger rail service may be a normal good, whereas passenger bus service is more than likely an inferior good [p. 46]."[8]

## ELASTICITIES OF DEMAND

Trends in trips, expenditures and income suggest that the income elasticities of demand for tourism activities as a group are more than one. For example, a 10 percent increase in income will lead to more than a 10 percent increase in expenditure on tourism. (The income elasticity of demand of individuals, or, for that matter, for groups of individuals for particular elements of tourist activity, may be well below unity without contradicting the conclusion about aggregates.)

However, analyzing demand and family expenditure is difficult, and full of complexities. The classic literature on elasticity analysis is not reviewed here. Note is taken, however, of the review article by Winston (1985). For demand, Winston reports favourably on models that examine the responses both to elapsed time of trip and cost (price) for various modes and trips. Estimates of price and service-time elasticities are reported.

Winston notes:

> These coefficients can be used to calculate estimates of price and service time elasticities of demand and decisionmakers' value of travel time. . . . In contrast to elasticity estimates for urban passenger transportation, service-time elasticity estimates for intercity bus and rail transportation tend to be larger than the price elasticity estimates. Furthermore, their large magnitude . . . indicates that reductions in service times could be significantly effective in increasing rail and bus-market share. Generally, the cost and service-time elasticities for air and auto are inelastic. This is not too surprising in view of the fact that these modes already possess a relatively large share of the United States' intercity travel market. (pp. 73–75)

## TRANSPORTATION RESPONSES TO TOURIST DEMAND AND SUPPLY

Some transportation developments take place in response to tourist use and demands. They may follow some developments and then induce further tourist development. Particularly good examples of this in Canada are Highway 400, north of Toronto; the Laurentian Autoroute, north of

Montreal; the Calgary–Banff–Lake Louise–Jasper–Edmonton highway and rail service; the early development of a good paved highway from Winnipeg to Kenora; and the Cabot Trail on Cape Breton Island.

Ancillary developments are also important to the transportation-tourism mix, and include: airport hotels; highway service centres; multi-purpose resort complexes; ski hills and lifts; marinas; and parks and camp grounds.

A particularly important activity for long-distance and foreign travel has been the development of reservation systems, tour packagers and wholesalers, and an industry of travel agencies. These serve both tourist and business travel.

## ENDNOTES

1. Kindleberger (1965), pp. 189–90. [Emphasis mine.] In more recent literature, the slowdown in economic development is sometimes attributed to the reduction in the redundancy of labour, with the consequent increase in real wages and reduction in real profits. See Cornwall (1977) and Boltho (1988).

2. On infrastructure and location of industry, however, see Munnell (1990) in the volume she edited for the Federal Reserve Bank of Boston.

3. Some of these activities may still be *natural monopolies* in the technical sense. Their activities may still be operating in regions where declining average costs are large relative to the total (narrowly defined) market. Even in these cases, however, there is generally more competition for the activity from close substitutes.

4. Kindleberger (1965) pp. 157–58.

5. These observations have often focussed on transportation, with the same alleged cause-effect relationships.

6. Fox (1990): "The Contribution of Infrastructure Investments to Growth: A Review of the Literature."

7. Essentially the same ideas are found in Mohring and Harwitz (1962), but are developed by them in a more technical way.

8. For a normal good, the income elasticity of demand is positive, though it could be large or small. For an inferior good, the income elasticity of demand is negative; that is, an increase in income, other things being equal, induces a decrease in the quantity demanded.

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## 5

# SUBSIDIES IN CANADIAN PASSENGER TRANSPORTATION

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## I. INTRODUCTION

The Royal Commission on National Passenger Transportation was established in October 1989. Its mandate is to make recommendations for an integrated national passenger transportation system that will serve Canadians well into the 21st century.

The Commission provides an opportunity for a much needed review of a wide range of practices and policies that affect the characteristics and costs of passenger transportation services in Canada. This paper is a part of the background research of the Commission. Its purposes are to provide, in a concise readable form, a comprehensive survey of the nature and role of subsidies affecting passenger transportation services in Canada.

The Commission has a unique opportunity to examine the passenger transportation system of Canada as a whole. It is important, therefore, that research which reports on the historical record of passenger services in Canada look beyond the modal orientation of past practices. This paper considers the general characteristics of subsidies, examines the attributes of subsidies in the individual modes and, finally, draws general conclusions.

## OBJECTIVES OF THE PAPER

The terms of reference for the paper encompass the following objectives:

- identification of the linkages, if any, between the types of subsidy, the mechanisms for the provision of subsidies, and the institutional characteristics of the services involved;
- assessment of the effectiveness of subsidy types and mechanisms; and
- assessment of the potential role of subsidies in the future.

## OUTLINE OF THE PAPER

The paper is divided into four sections. Following the Introduction, Section II describes the various characteristics of subsidies, including the types and purposes of subsidies, the economic effects of subsidies and the desirable attributes of subsidy mechanisms. Indeed, there is such a variety of subsidies that the second section of the paper begins with a definition of "subsidy."

The frameworks used to describe subsidies provide structures for the survey of the role of subsidies in the various modes of passenger transportation in Canada. Policies and programs exist on a modal basis for a variety of reasons. For convenience, the survey is presented by mode in Section III, concluding with a synopsis of the record of subsidies.

Section IV presents conclusions based on the Canadian experience to date which provide a basis for recommendations on the direction of policy and on further research to assist the framing and application of this policy.

# II. CHARACTERISTICS OF SUBSIDIES

This section provides an overview of the nature of subsidies affecting passenger transportation services in Canada. Because of the great diversity of specific subsidies, they have been placed into broad categories. At times, this has involved making some somewhat arbitrary allocations.

## DEFINITION OF "SUBSIDY"

The Commission is considering the impact of a variety of government programs and policies on the roles of the various modes of transport in serving the passenger transportation requirement of Canadians. This paper deals with those programs and policies that involve subsidies.

The breadth of perspective adopted here is appropriate to the broad mandate of the Commission. The Commission needs a perspective on the influence of subsidies in passenger transportation equivalent to that being developed by the ministers of agriculture in various countries who are trying to develop a common international measure of the effect of subsidies on agriculture. Their solution, the Producers Subsidy Equivalent Measure, places a wide range of policies into a consistent framework which allows the effect of diverse programs on agriculture to be measured. Faced with a wide range of subsidies in passenger transportation, the Commission has a similar task.

The term "subsidy" carries a variety of meanings. Subsidies are most frequently thought of as grants or payments from the government to aid a particular group. This interpretation is the basis of many studies of subsidies. Subsidies, however, may take a variety of forms. They may be implicit as well as explicit. They may also be accidental as well as deliberate. They may result in the absorption of private costs by the public rather than an actual transfer of public resources to private interests. All subsidies, however, increase the value of benefits relative to costs accruing to the providers or users of a service. Therefore, they affect the output of individual services and the relationship between competing services. They affect the role of the modes of transportation in serving Canadians' needs.

For this paper, subsidy is defined as "a transfer of benefits to or costs from an affected party by an implicit or explicit program or policy." This definition is sufficiently broad to encompass the wide variety of types of subsidy considered below. The result of such programs or policies is usually a greater output of the subsidized good or service than warranted in the absence of the subsidy.

The immediate expense of a subsidy is a cost to society, whether it falls on some or all members or whether its effects are channelled through government. A subsidy program should only be continued willingly and knowingly, if the total value of benefits exceeds the total value of costs. A subsidy might be made available to all industries — for example, a grant in relation to research expenditures — or it might be made available selectively. A subsidy will often involve different treatment of one firm or industry from another. For example, the management of international shipping has been given tax-free status in Canada under particular conditions, effective March 1, 1991. This is classified as a subsidy here. The effects of the subsidy and whether it has merit are separate issues to be considered in the light of domestic and international conditions of this industry.

## TYPES OF SUBSIDY

Several means exist by which income may be transferred with the result that the output of a good or service is larger than would otherwise be the case. There are four categories of such means, each requiring an explicit or implicit public decision. The public may pay for services; the public may provide services; the public may protect services; or the public may absorb costs created by services. Exhibit 1 is a summary of the types of subsidy discussed here.

This classification structure encompasses a broader range of subsidies than are normally considered. Most studies focus on direct subsidies involving payments; these are most easily identified. However, the full effect of government intervention requires a broader approach. A report by the Organisation for Economic Co-operation and Development on government intervention places subsidies in six specific classes.[1] They are cash expenditures; preferential credits; tax expenditures; subsidy equivalents of regulatory measures; possible subsidy elements in public purchasing contracts; and subsidy equivalents of tariffs and non-tariff barriers to trade. The classification used here places subsidies in fewer, generic classes. It has the advantages of highlighting the general nature of the promotional policies and of avoiding detailed technical listings.

Exhibit 1

### SUMMARY OF TYPES OF TRANSPORT SUBSIDY

A. Subsidies which the public pays
- *ex post* compensation for unremunerative services
- *ex ante* compensation
- support for research and development
- tax concessions

B. Subsidies when the public provides facilities or services
- unremunerative services provided to travellers
- operation of unremunerative facilities and related services
  - routes
  - terminals
  - vehicles (not applicable to passenger transport)
- implicit capital subsidy of Crown corporations

C. Subsidies associated with the protection of services
- cross subsidies by regulated monopolies

D. Subsidies by the absorption of costs
- loan guarantees
- environmental externalities

**Subsidies Which the Public Pays**

Subsidies which the public pays may come in a variety of forms. Some may involve actual payments, others may enhance the net cash flow of undertakings by providing tax concessions. The programs are described in four categories: *ex post* compensation, *ex ante* compensation, payments for research and development and tax concessions.

Ex post *compensation:* Payment to a company for an imposed public service provided at a loss, but which is required in the interests of society, is the most obvious form of a subsidy in transport. It is compensation to the provider of the service for the losses incurred. The primary beneficiaries of the subsidy are the users of the service. After the *National Transportation Act* (NTA, 1967) and until the formation of VIA Rail in 1978, CN and CP received compensation for 80 percent of the losses they incurred in the provision of intercity passenger services. This was an *ex post* payment system.

Ex ante *compensation:* The *National Transportation Act, 1987* (NTA, 1987) has provision for an *ex ante* subsidy system should it be desirable to maintain airline services existing in 1987 but which are no longer remunerative. Section 85 of the NTA, 1987 requires that unremunerative services that are to be maintained should be contracted following competitive tendering.

The payment of compensation to carriers for losses resulting from the imposition of a public duty was an important recommendation of the MacPherson Royal Commission in 1961. It was incorporated in the statement of national transportation policy in the NTA of 1967 and is unchanged in the NTA, 1987. Paragraph 3.(1)(f) of the latter Act states: "each carrier or mode of transportation, so far as practicable, receives fair and reasonable compensation for the resources, facilities and services that it is required to provide as an imposed public duty."

Compensation is appropriate for two reasons. First, as transportation markets become more competitive, it is no longer possible for carriers to earn a sufficiently high profit in some markets to offset losses in another. The effect of competition on the railways made this abundantly clear to the MacPherson Commission. Second, even if the cross subsidy of one service by another is possible, it is inappropriate for one sector of society, identified by chance through the importance of a particular service to them, to pay the subsidy decided appropriate by society at large. This would amount to selective taxation.

Using the railways as an example, and supposing that cross subsidies were possible, it would most likely be the shipper of bulk natural resources from remote locations that would pay the high rates to cover the cross subsidy requirement. A cross subsidy is possible when an enterprise is able to earn some economic rents or excessive profits in a market with limited competition. An inefficiently small output is produced in the "taxed" market.

*Payments for research and development:* Subsidy payments may be made to carriers for the support of research and development otherwise unattractive to a company. No actual service to the public may be provided immediately. However, on occasion, a service may be involved, as with the experimental short-take-off-and-landing (STOL) service operated by Air

Canada between the island airport in Montreal and Ottawa between 1973 and 1976. Users will benefit coincidentally from the greater range of service available (while some other suppliers may be losers).

*Tax concessions:* Various forms of tax concessions may be used to enhance the cash flow of tax-paying organizations and, thereby, stimulate certain activities. Examples of concessions could include exemption from consumption taxes otherwise payable, for example, a fuel tax; tax credits for certain expenses incurred, for example, research expenditures; and acceleration of capital cost allowances on particular classes of assets for an industry.

Tax concessions may be viewed as "tax expenditures," a term used to denote the tax revenue foregone. Subsidies provided by tax concessions are less visible than direct payments. They are also less readily measured. The amount of tax foregone on a consumption tax may be easier to estimate than the amount foregone through accelerated capital cost allowance. The latter only applies when firms are earning profits.

### Subsidies When the Public Provides Facilities or Services

Subsidies when the public provides facilities or services arise in a variety of situations when the revenue generated by the facilities or services do not cover their costs. The immediate beneficiaries are the users of those facilities and services. If these beneficiaries are suppliers of services in a competitive market they may be forced to pass on the benefits of the subsidy to consumers. The subsidies that exist in the provision of facilities and services to carriers are in spite of the principle advanced by the MacPherson Commission and reflected in the NTA, 1987, paragraph 3.(1)(e), namely, that "each carrier or mode of transportation, so far as practicable, bears a fair proportion of the real costs of the resources, facilities and services provided to that carrier or mode of transportation at public expense."

*Unremunerative services provided to travellers:* The public provides some services directly to the public without covering the costs from user revenue. Ferry services are an example. They range from the extensive deep-water services in Atlantic Canada to short crossings of rivers throughout Canada. VIA Rail is also an obvious example, although it is appropriate to note that VIA purchases a significant component of the transport operation from CN and CP Rail.

*Unremunerative facilities and services for routes:* The public also provides infrastructure and services which must be used in conjunction with other assets to create transportation services. Public expenditure provides routes both in the form of physical structures and of services. The largest public investment in the nation is the network of roads provided for the operation of private and for-hire vehicles. As well, navigation aids and a variety of services are provided to facilitate the operation and safety of air and marine services.

*Unremunerative facilities and services for terminals:* Passenger terminals are currently provided at public expense in the case of airports, and, in the special case of cruise ships, in ports. For both routes and terminals, the losses incurred may be visible in the sense of shortfalls in revenues against costs, although they may be difficult to quantify accurately. Hidden subsidies may also exist — for example, the absence of taxes on public land. This is a subsidy in the sense that competing land uses have to pay taxes.

*Implicit capital subsidies of Crown corporations:* The public provision of services by government may involve subsidies which are hidden in the capital structure. The cost of capital to a government agency is reduced by the assurance provided by state backing. The cost of capital does not reflect the true risk associated with the investment undertaken. The effect of risky projects on the cost of capital is a continuing concern for private firms, even though the effects of independent projects are averaged across the activities of a firm.

### Subsidies Associated With the Protection of Services

The output of firms may be made more profitable by providing protection against competition. This may be achieved by tariffs or quotas that keep out foreign goods, thus protecting domestic goods or services by the regulation of entry into the industry.

The transportation industry has been subject to a wide range of economic regulation, including entry control for a variety of reasons. They include the avoidance of destructive competition, protection of "infant industries," and the interest in preserving the ability of carriers to meet public service or common carrier obligations. The latter category has really meant that carriers sustain unremunerative services by cross subsidizing unprofitable services from profitable ones. The cross-subsidy structure has been sustained by precluding competition on the profitable routes. The effect is to support a subsidy mechanism through selective taxation achieved through the regulatory process. A recent high-profile example of this policy is the regulation of entry into the telephone industry and the cross subsidization between long distance and local calling services in that industry.

An example of this policy in passenger transportation is in the regulation of bus services in Quebec and Saskatchewan, where there is strong concern to preserve services to small communities. The latter concern had also been reflected in the service mix operated by Air Canada when it was a Crown corporation.

Regulation may be introduced and administered to achieve cross subsidization. However, it may also simply create an environment in which cross subsidization evolves because of the passive role of authorities in regulating rates and because of the diminished market discipline faced by carriers.

Cross subsidies most often become evident when firms are faced with a loss of earnings from their protected markets. For example, cross subsidies have become issues as competition from other modes erode the earnings of main bus routes and as potential competition stimulates "rebalancing" in telephone rates.

## Subsidies By the Absorption of Costs

The costs of doing business may be absorbed by society in two quite different ways. The first is frequently recognized as a form of indirect subsidy. The second is less often thought of as a subsidy.

*Loan guarantees:* Loan guarantees are frequently used by government to enable capital to be available to companies, or available to companies at lower rates than otherwise would apply. The result is that the costs associated with the possibility of the venture failing are shifted to government.

*Environmental externalities:* Externalities are the consequences, positive or negative, of an activity on others and for which the supplier does not receive or pay compensation. Externalities have long been recognized as important in transport. For example, the consequences of added traffic on a route, whether highway, airline or canal, can be delay to other vehicles. The immediate effects of congestion are internal to the particular transport system. They result in inefficiency but not directly to the subsidization of the mode. Air and noise pollution, however, are externalities exacerbated by congestion; they are examples of costs imposed on society. These externalities fall on society in a general sense, not on government. The incidence of externalities within society varies with their specific nature.

Differences in accident rates among modes of transportation are also associated with an externality to the extent that the health care costs resulting from accidents are borne by government and not by the affected travellers.

The environmental consequences of transportation are becoming more widely recognized. While the costs are being reduced by a variety of measures, such as non-leaded gasoline and mandatory seat belts, they are not eliminated. Their values are difficult to estimate but differ among the modes. The effects of their absorption by society on modal output is uncertain. (It should be noted here that the environmental performance of modes must be judged on the basis of their effects in relation to actual passenger transportation performed and not on the basis of their potential performance.)

## PURPOSES FOR SUBSIDIES

In view of the various types of subsidies, it is not surprising that while all subsidies have explanations, some have more explicit purposes than others. Before these purposes are discussed, it is helpful to recognize important attributes of subsidy programs in practice.

First, not all subsidies are the result of deliberate programs. While many subsidies are intentional, others are coincidental and still others are accidental. An example of a deliberate subsidy is payment to VIA, but the saving in the cost of capital attributable to Crown corporations is coincidental. Such a coincidental subsidy could reasonably have been anticipated, but the subsidy flows from the program of Crown ownership which was introduced for other reasons.

Some subsidies have come into existence "by accident." An example of such an accidental subsidy is in the failure of the St. Lawrence Seaway to come up to early expectation and cover its costs. This situation produces a "subsidy" in the sense that the users will not be able to meet the system costs. However, where a loss arises from an investment decision which, with the benefit of hindsight, was inefficient, no "subsidy" should be considered to exist. The sunk costs are now irrelevant. In the long run, there will be questions about the ability of the service to cover future costs.

Second, subsidy programs frequently lack clarity of purpose and recognition of costs. Given the variety of political considerations surrounding many subsidies, obfuscation may be politically expedient. However, as will be argued later, it can be a major contributor to the high cost and ineffectiveness of a subsidy in achieving desired objectives.

Subsidies may be introduced to achieve a variety of purposes. This is particularly true of the transportation industry which affects so many aspects of society. Although individual subsidies may contribute to several purposes related to various broad goals of society, the reasons for subsidies to passenger transportation are restricted to three broad categories: contributions to nationhood, change in income distribution and increase in economic efficiency; these are listed below in Exhibit 2.

*Exhibit 2*
*SUMMARY OF THE PURPOSES FOR SUBSIDIES*

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A. Contributions to nationhood
  - defence, justice and social services
  - idependence
  - political unity
  - prestige
  - preservation of culture

B. Income redistribution

C. Economic efficiency
  - public goods and services
  - externalities
  - decreasing costs
  - inadequate information

### Contributions to Nationhood

Transportation contributes to nationhood in various ways. The relative importance of these contributions changes over time and varies between countries, but collectively they exercise continuous and strong influences.

*Defence, justice and social services:* An independent, sovereign state must have the mobility as well as the resources to ensure the administration of justice and the performance of national defence. Historically instrumental to the construction of early trunk roads, these fundamental requirements still have their relevance. The establishment and maintenance of Canadian sovereignty in the Arctic islands require a sufficient Canadian presence — a presence which still must be supported from government budgets.

In the social area, a current transportation-dependent service which Canadians might expect to be able to provide to all communities is access to health care. While not a necessary attribute for a nation, it may be a fundamental service expected for communities, irrespective of their economic opportunities. Such accessibility is provided by air transport.

*Independence:* Transportation played well-known roles in ensuring Canadian independence and sovereignty. Each mode of transportation has its example. Observation of Canadians' behaviour in selecting their travel routes today suggests that the need to preserve independence by "buying Canadian" no longer seems relevant. However, in political debates, the preservation of Canadian alternatives, be they companies or routes, is a well-known argument. How important independence is in this argument and what it currently means are not clear. It is certainly in the minds of some. However, the protection of their own capital and of their own jobs may be in the minds of others.

*Political unity:* The basis for political unification of disparate geographical units into one Canada has been achieved, in part, by offsetting the economic cost of distance with subsidies. Railway service and, later, the reduced freight rates for Atlantic Canada, and the promise of a railway to British Columbia were the early forms of this. The later extension of the Maritime freight subsidy to trucking in Atlantic Canada, and the operation of buses for rail passenger service in Newfoundland have been efforts to make the subsidies more cost effective.

*Prestige:* National symbols are important. Sports heroes such as Pelé and Gretzky, and participation in the Olympics are evidence of this. So too, apparently, are national airlines, given the number of countries that have one. While Canada, unlike many developing countries, has resisted the need for a national shipping line, we are now testing the importance which we attach to Canadian-owned airlines. (Related issues in the current airline policy debate include the competitiveness of markets and the equality of opportunity for Canadian and foreign firms to behave and compete in comparable ways.)

*Preservation of culture:* Assertion of community cultural values is a strong phenomenon of our times. Within Canada, it may take the form not only of greater identity within various ethnic and cultural groups, but also of sustained concern for preserving Canadian values in the face of the Free Trade Agreement and broader trends to globalization.

The environment gives rise to concerns for the preservation of "things Canadian," quite possibly including the continuation of transcontinental rail passenger service. The argument might go: "Canada would not be the same without it; the railway laid the foundation of the country." If unremunerative rail service is to be retained, the Commission may have to decide whether rail service has cultural value in an evolving and dynamic society. Of course, there may be other reasons for subsidizing rail service. (This does not deny that there may be economic as well as cultural value in operating museums, as the number of steam-engine rail services and paddle-wheel cruises testify.)

### Income Redistribution

Regionalism is strong in Canada for geographic and cultural reasons. The country early used railways as an instrument to attract remote regions into Confederation. Subsequently, the subsidization of transportation was used to promote regional economic development. In effect, this is a way of taking wealth from the "haves" and using it to enhance the economic opportunity of the "have nots." The Hudson's Bay railway is a costly example.

Transportation may also be subsidized to provide enhanced mobility for particular sectors of society. For example, it is argued that the maintenance of subsidized rail service facilitates the mobility of poor and physically disabled people. (Rail service can offer persons with disabilities better mobility while travelling than can bus service.) The requirement that carriers provide extra facilities for disabled persons could result in services at less than cost. In the absence of public compensation, this would require cross subsidies.

### Economic Efficiency

There are many arguments for the provision of subsidies to increase the efficiency with which a nation's resources are used. Subsidies may be used to enhance the efficiency of the economy rather than to redistribute wealth for public reasons but at an economic cost. However, subsidies introduced for efficiency reasons will have some distributional consequences. They may also have some offsetting side effects on efficiency in the economy, as discussed in the next subsection. Subsidies intended to enhance efficiency have their costs as well as benefits.

The economic arguments for such subsidies can be placed in four categories. They are: inefficiencies in the provision of public goods and services; the influence of externalities; decreasing costs; and inadequate information.

*Public goods and services:* Public goods and services cannot be efficiently marketed. A consumer can derive a benefit from the service without adversely affecting consumption by others. The classic example is the service provided by a lighthouse which is available to all ships without any effect on lighthouse costs. The marginal cost is zero; therefore, the appropriate price is zero.

The view of roads as public goods was important during the early development of roads when they primarily provided property access and were, in general, little used. The increased use of roads and their use for long-distance travel rather than access, have changed their nature. The costs of providing additional road capacity for users have become significant, and control of access to divided highways through tolls or similar means has become practical.

*Externalities:* Economists' models of perfect competition assume that suppliers and consumers experience the full consequence of their actions. This is not the case in reality. For example, transportation gives rise to a number of effects felt beyond the individual supplier or user. Externalities, as noted earlier, are relevant here as they may give rise to conditions warranting subsidies.

Where externalities are positive, a subsidy may be appropriate to encourage an expansion of output to an optimum level. A frequently cited example is the case for a subsidy to orchard owners to reflect their contribution to the value of honey produced by separate beekeepers. An example may occur in transport when an increase in the number of users of a scheduled service enables service frequency to be increased, to the benefit of all users. The result for a service charging marginal cost, taking into account producer and user costs consistent with economic theory, is that marginal cost is declining and that a subsidy is necessary for the service to be financially viable.

Transport services produce a number of negative externalities. Most widely recognized are air and noise pollution. These externalities may be dealt with directly through taxes or regulations, or by encouraging other activities or modes of transport which do not produce these negative externalities. Subsidies are suggested for bus and train to offset the negative externalities of the automobile.

This is the appropriate place to discuss the issue of energy conservation. There are four points to make. First, if energy prices reflect scarcity, there is no reason for specific intervention. Second, energy is only one of a number of inputs. Forced conservation of energy will likely result in waste in other resources such as capital. Third, energy conservation at one stage in production may result in higher energy consumption at others. It is necessary to look beyond the immediate process. Fourth, energy consumption must be related to the work performed, not the technological possibilities. For example, a full aircraft may require less oil per passenger trip than a train with 20 percent occupancy.

*Decreasing costs:* Charging an efficient price equal to marginal cost will result in a loss when a firm's cost per passenger or ton falls as the total amount of traffic carried increases. This condition may arise when there are increasing returns to scale — for example, larger vehicles are inherently more efficient — or if there is a surplus of capacity which may be caused (temporarily) by lumpy investment. Losses may be avoided in two ways. One method is for the public to subsidize the service. An alternative method is to allow the carrier to practice price discrimination, that is, to charge different users different prices. This is the approach used by airlines in seat management and by VIA in the pricing of services.

A particular form of the increasing-return argument is for infant industries which may not currently be efficient or viable because of small size but subsequently should grow into viable and profitable firms. The infant industry may justify "start-up" subsidies; the early protection of Trans-Canada Airlines might have fallen under this category.

*Inadequate information:* A final condition that may justify a subsidized activity is inadequate market information. For example, consumers may lack knowledge which may justify government support of consumer groups.

## THE ECONOMIC EFFECTS OF SUBSIDIES

Whatever the reasons for subsidies, it is important that their effects be continually assessed. From the time that they are inaugurated, it is appropriate to consider the benefits and the costs, and how the effects vary with the level of subsidy. Questions should be asked not only about the existence of a subsidy but, if justified, whether it is at the right level.

The economic effects of subsidies are derived from the obvious: subsidies change behaviour. The major difficulty with the analysis of subsidies is the impracticality of forecasting all of the effects *ex ante* or of identifying and measuring them *ex post*. In a dynamic world this is of little surprise, but it is of no comfort.

A study of government intervention in OECD countries[2] notes that it is impractical to carry out theoretically correct comprehensive analyses of subsidies. The absence of detailed data requires levels of assumption that makes partial analysis more appropriate.

The effects of subsidies depend on attributes of the buyers and sellers of goods and services. These attributes are discussed in the following pages before an examination of the nature of the economic costs of subsidies and of the unintended and, generally, indirect effects of subsidies. The section concludes with a consideration of some issues raised by the incomplete recovery of costs for publicly provided facilities and services.

## The Importance of Buyer and Seller Responses

Subsidies are designed to change the consumption of particular goods or services. The extent to which they achieve this is dependent on the elasticity of supply and demand, that is, the extent to which the behaviour of the buyer and seller is influenced by changes in price. If the amount supplied and demanded are both highly responsive to price, a significant change in output will result from a subsidy. If neither are responsive to price, little change in output will be achieved.

Further, the extent to which a subsidy is consumed by suppliers' cost increases rather than realized by buyers in increased consumption is dependent on the relative elasticity of supply and demand. In a situation where suppliers face sharply increasing costs, much of the subsidy will be consumed by the supplier. If supply could be increased without limit at a constant cost, the benefits of a subsidy would accrue to users.

Assessment of the effectiveness and incidence of subsidies is critically dependent on a knowledge of the elasticity of supply and demand for the service concerned. The elasticity of demand is affected by the availability of substitute services. The elasticity of supply is affected, also, by the amount of competition.

When buyers or users of a transportation service benefit from a subsidy, it is important to distinguish between those that realize a "windfall" gain, and those that benefit from the subsidy shift. Travellers that would have been using a service anyway, get the windfall gain. Those that use the service because of the subsidy are the intended targets of the subsidy. (Given the general willingness of foreign tourists to pay a much higher [probably commercial] rate for rail service, it would be interesting to know the proportion of foreign tourists that use VIA service between British Columbia and Alberta!)

## The Direct Economic Costs of Subsidies

In theory, the economic cost of a subsidy is not measured by the expenditure of the subsidy, whether in the form of cash payment or tax revenue foregone. Such expenditures are merely transfers from one group in society to another. The economic cost should be measured by the value of output foregone as a result of the transfer. That depends on conditions in the economy and the mechanism by which the revenue is raised. As a practical matter, payments (as distinct from tax expenditures) are presumed to be economic costs. They may overstate the economic costs; for example, the social cost of labour may be overstated during a period of high unemployment. However, they are more likely to understate the *total* economic cost.

Costs are incurred not only by the need to transfer resources from one sector to another by taxes, but also by shifts in the consumption of substitute services. For example, subsidies to rail service results in transfer of passengers from air, car and bus services. The substitution effect is believed to be greatest on bus service. The effect is to lose the net value of some bus service, together with the cumulative effect that this has on the value of bus service frequency. A transfer of travel will also take place from car to rail, which may be associated with an immediate net gain because of the negative externalities associated with car travel. In the example, the additional loss in value from bus travel might be offset by the reduction in externalities of car travel.

However, perhaps a more important source of cost, than the inefficiencies resulting from marginal shifts in resources from more to less productive uses, is the behavioural response of buyers and sellers. Presumption that the economy is efficient when prices are set on the basis of appropriate concepts may be seriously in error when suppliers are protected from market forces. This is now a matter of increasing concern to the World Bank.[3]

Three aspects of behavioural response are important. First, because of subsidies, suppliers may be protected from the rigours of the market and become less innovative and efficient. Second, those providing goods or services to suppliers may be able to achieve some economic "rents," that is, returns higher than competitive market conditions would warrant. This might be true for various inputs provided to VIA. Third, consumers may be lulled into the acceptance of service and productivity conditions not otherwise acceptable. This is currently evident in the response of users to government proposals to increase cost recovery in the marine and air modes. Faced with new charges for facilities and services, carriers are demanding greater efficiency in supply. The collective result of these three responses can be a significant detraction from the efficiency of supply. The indirect costs of subsidies can be large.

## The Indirect Effects of Subsidies

The behavioural response of suppliers and consumers just outlined are unintended. Other unintended ramifications of subsidies are of concern here.

Subsidies have indirect ripple effects, the magnitude of which are not easily identified with subsidies. The well-known Canadian example is the effect of subsidies on the movement of grain by rail. The effects include a shift in meat processing out of the Prairie region; concentration on grain monoculture in the Prairies with various economic, environmental and social effects; a stultified trucking industry; and a high-cost grain logistics system. These effects of holding down the rates for rail transportation are well known. Getting rid of the inefficiencies is not easy because groups develop vested interests.

Subsidization of passenger transportation can have comparable effects. Take the case of subsidizing rail and bus services in southern Ontario, to offset the externalities of the car. The result? Low-cost transport and the consumption of more transport than is warranted. Social and economic choices are geared to the low apparent cost of transport. Community growth and travel behaviour are more transport-intensive than would otherwise be the case. Long work trips by rail, as well as by car, may become more common, while low-density living will result in reliance on the automobile for local and other trips.

The examples of grain and passenger transportation demonstrate the important interrelationship that exists between land-use patterns and transportation. The effects vary with the subsidy from local to national in scale. The magnitude of the effects depends on the relative importance of transportation in location choice. When transportation subsidies affect locational decisions, they have deep and long-lasting effects.

## Subsidies and Cost Recovery

Some subsidies exist in transport because fees collected from users of publicly provided facilities and services may not cover the costs those users impose on the system. This applies in each of the modes of transport and gives rise to issues worthy of special attention.

Unfortunately, the reasons for less than full cost recovery are not generally known. It may be that subsidization has been intended for reasons of nationhood, income distribution or efficiency. However, it may also be that practices followed when the national infrastructure was being developed have been continued because of the various technical and political difficulties in implementing user charges. Subsidies may have evolved by default.

The role of infrastructure has changed as the economy has matured (and as technology has changed). Infrastructure which was capital-intensive and little used originally required public support, for example, roads and railways. Traffic on roads has increased greatly; in fact the issue has often shifted to one of dealing with congestion.

Second, economic growth and technological change have diminished the importance of specific facilities to nation-building, and alternate pricing has become practical. The volume of traffic is sufficient to pay for facilities, and practical methods exist or are becoming available to implement charges. This is not the place to examine the various issues and mechanisms for implementing user-charges to achieve cost recovery. It is sufficient to note here that Canada has not and is not pursuing these aggressively! Witness the exclusion of recreational boaters on the recent government proposals for user-charges on waterways. Developments in road pricing and private funding for roads are examples of the technological and attitudinal changes affecting highway finance, especially in other countries.

In theory, efficiency is maximized if tax revenues are raised from sources that have least effect on the (assumed) efficient allocation of resources in the economy. Following this principle, taxes would be increased on goods and services with inelastic demands. This argues for general revenue funding, which provides government with the greatest flexibility in raising and allocating tax revenues. These advantages must be weighed against the tendency toward inefficient supply when users and suppliers are not subject to pricing discipline. The combined result is that arguments are arising for the collection of user-charges sufficient to cover facility costs and for these revenues to be placed in dedicated funds.

## SUBSIDY MANAGEMENT

The management of subsidies covers many tasks, including deciding whether a subsidy is warranted, selecting the type of subsidy and managing the subsidy program. A summary of management considerations is presented in Exhibit 3.

*Exhibit 3*

### SUMMARY OF SELECTED SUBSIDY MANAGEMENT CONSIDERATIONS

A. Desirable attributes of subsidy programs
- provide direct subsidies
- subsidies should allow market competition
- subsidies should not distort input costs
- subsidies should be transparent
- subsidies programs should be monitored and results publicized

B. Deciding on a subsidy program

C. Financial subsidy administration
- competitive tendering
- operating tenders
- negotiated service contracts
- *ex post* subsidies

## Desirable Attributes of Subsidy Programs

The management of subsidies should be guided by generally desirable attributes of subsidy programs. Subsidy programs are considered effective when resources are used efficiently to accomplish the program objectives and when the cost and effectiveness can be monitored over time. Unfortunately, many subsidies do not have these attributes, and the beneficiaries of subsidies would often rather hide the existence of the subsidy, perhaps for fear of losing the benefit. Five program attributes are recommended to ensure that services are provided efficiently and that desired results are achieved.

*Provide direct subsidies:* Subsidies are most effective if provided as directly as possible to the intended beneficiary. First, the process requires explicit recognition of beneficiaries, a process likely to cause a critical assessment of the subsidy's merit. (For example, the subsidy per passenger given to tourists going on the Algoma Central tour train might cause taxpayers and competing tourist attractions to take exception.) Second, the effectiveness of the subsidy could be enhanced by leaving the beneficiary with an unbiased choice of transportation to be used, rather than by subsidizing a mode or carrier. If the "pay-the-farmer" policy makes sense for efficient grain transportation, so does "pay-the-traveller" policy for efficient passenger transportation, if a decision to provide a subsidy to this group has been made.

*Subsidies should allow market competition:* The effectiveness of subsidy expenditures will be enhanced by mechanisms favourable to competition. Maintaining competition reduces the risk of a subsidy inhibiting innovation and efficiency. An example is the use of competitive service tendering as a means to ensure that, even if a specific service is subsidized, competition is effective periodically, that is, at the time of tendering. Subsidies, including service tendering, should be structured to allow intermodal as well as intramodal competition as far as possible. When subsidies are introduced to benefit the mobility of travellers, the competitive balance in the transportation market and the effects on innovation are affected least by following the "pay-the-traveller" policy.

*Subsidies should not distort input costs:* Subsidies which distort management decisions on resource inputs should be avoided, unless they are specifically needed to correct otherwise inefficient input costs. They should not be used as a general form of subsidy. For example, providing tax relief through accelerated capital cost allowances, or providing low-cost capital, provides incentives for an organization to use capital more intensively, perhaps in place of labour or fuel. When capital costs are subsidized, it may be necessary to introduce offsetting investment rules to avoid waste, as evident in the controversy which has surrounded the use of capital by the transit systems in Ontario.[4]

Lump sum payments, whether paid after tendering or negotiation with a selected provider, are least likely to distort supply efficiency. The duration and monitoring of contract provisions are important to the sustained efficient performance of suppliers.

*Subsidies should be transparent:* Subsidies should be visible and their purposes clearly stated. It is unfortunate that many subsidies lack these important attributes.

Visible subsidies involve explicit financial transfers. Subsidies achieved through concessions and protection from competition are difficult to identify and even more difficult to quantify.

The purposes for subsidies should be spelled out with care. Transport is not subsidized for its own intrinsic value. Subsidies may be provided for transport to remote regions, but it is not "the regions" that are subsidized, but the particular travellers and interest groups.

For example, a rail service into a remote area may serve three broad clientele groups. The first are the local residents who may or may not have alternate means of travel and who live in the area for a variety of reasons. The second group is made up of the travellers who might come to such regions for the fishing or hunting and to stay at recreation lodges and facilities. Rail service may be one form of access providing a benefit to these travellers as well as to the lodges they visit. The third group may be thought of as wilderness travellers who use the rail service to get to a remote location, where they are then self-reliant. When the rail service is subsidized, and low rates are provided to everyone, all travellers are subsidized by the taxpayers; is this intended?

The reasons for subsidizing mobility for residents are likely different from the reasons (if any) for subsidizing other travellers. In order to examine alternatives, the explicit reasons for subsidies must be revealed. (An interesting condition sometimes applies in remote regions served by rail, under which existing lodges do not want lower-cost road service provided, since the presence of more vacationers would detract from the "wilderness" assets that they enjoy.)

*Subsidy programs should be monitored and results publicized:* Careful, explicit rationales for subsidies provide the basis for effective monitoring programs. The more direct and explicit a program, the easier and the more likely is the conduct of program evaluation. The effectiveness of the subsidy in relation to program goals and the incidence of costs and benefits should be estimated and reported.

Experience with monitoring subsidy programs is not good. Programs involving expenditures are reported through records of departmental and agency budgets and records. However, except where an agency, such as the National Transportation Agency, has responsibility for a subsidy program, reporting is subject to limited visibility. Critical assessment of the effectiveness and incidence of subsidy effects is usually not carried out.

Subsidy program assessment raises difficult questions about whether assessments should be carried out by program officials or by staff with special expertise in evaluation methods. Difficulties also surround the way results are reported. Recipients and their elected representatives are normally reluctant to see subsidies analyzed and the results publicized. Their perspective is commonly dominant, to the detriment of taxpayers in general and, often, to the detriment of subsidized interests themselves as the effectiveness of subsidies diminishes. Subsidies may even become counter-productive.

### Deciding On a Subsidy Program

The management of subsidy programs is about choices. For choices to be made well and for programs to be managed efficiently, transparency and explicit decision processes are essential.

To decide whether or not a transportation subsidy is warranted cannot be a technical process. Judgement will always be important in weighing intangibles and making trade-offs between heterogeneous considerations. However, guidelines can help in the selection of effective programs. They are intended to ensure sufficient information to support rational and effective choices, and include:

- Clear identification of program goals, whether related to nationhood, income redistribution or economic efficiency;
- Consideration of transport and non-transport alternatives;
- Consideration of alternate amounts of subsidy;
- Evaluation of alternatives by such techniques as cost-benefit analysis or cost-effectiveness analysis; and
- Detailed description of the expected distribution of costs and benefits.

The guidelines reflect several important aspects of program choice, emphasizing the different means of achieving goals. There is a right size as well as type of subsidy. A knowledge of the distributional effects of a subsidy is different from and must be weighed with other costs and benefits.

Allowances must always be made for uncertainty in subsidy effects, especially in unintended side effects. Directness of subsidies, the preservation of competition as far as possible, and good monitoring programs help to increase the effectiveness of programs.

**Financial Subsidy Administration**

Various methods used to provide direct financial support to transportation firms reflect the structure of the industry and government policies. For convenience, four categories of methods are used.

*Competitive tendering:* Competitive tendering has become more popular for the provision of subsidized services, in conjunction with the move to private provision of public services, as is evident in the United Kingdom, for example. It is most common in Canada in the provision of transit services in small communities. Competitive tendering requires the careful specification of service requirements, itself a beneficial discipline for public (and private) organizations involved in contracting out. The establishment of successful service standards is evident in the contracting of emergency health-care services.

The tendering process is intended to provide the advantages of competition in terms of innovation and efficiency among alternate suppliers. The competitive advantage is realized each time a tender is opened, although the life and versatility of the assets affect the optimum life of the contract period. While an incumbent normally enjoys some advantages on retendering, competition still remains an important influence.

Tendering may allow for some versatility in service design. For example, a community may allow applicants to use large or small vehicles with different service frequency or, alternatively, may define a service level, including the type of equipment to be used. The former approach allows greater scope for innovation.

Services such as bus or air service lend themselves to the tendering process. In rail transportation, the normal service regime provided by the company owning the infrastructure is not consistent with competitive tendering. However, if a separate contract is issued for passenger services to use a railway track, competitive rail tendering would be possible. The practicality of independent rail passenger service is evidenced in Western Canada where one private rail service to Calgary is already approved and a second is being planned.

*Operating tenders:* While service tendering requires the provider both to supply capital stock and to assume operating responsibility, an operating tender requires only the latter. Capital equipment is provided by the government. This is the case in Ontario, for example, where capital subsidies are used to provide buses, which in some municipalities are operated and maintained by private contractors. While this may result in some advantages derived from centralized buying power and standardized equipment, it has the disadvantage of curtailing innovation and responsiveness to local conditions.

*Negotiated service contracts:* Where competitive tendering is not possible, negotiated service contracts may be used. Such is the case for BC Rail's passenger services which are subsidized by the province. Negotiated contracts can involve careful service definition and agreed levels of capital investment and operating subsidy. In the case of a "captive" Crown corporation, the quality of the contract is very much dependent on the attitude and ability of the individuals involved. Competition does not provide any check.

The contracts, like tender arrangements, can include penalties for service failures and can provide incentives for the achievement of additional revenues.

Ex post *subsidies:* Subsidies may be provided to public services on an "as-needed" basis. Under such regimes the level of service may be tightly or loosely defined. In either case, the shortfall will be made up by government. Budgets, however, would normally be subject to government approval. The system operates as a cost-recovery process. Consequently, incentive for innovation may be low but the risks of innovation may also be low, at least for the organization, if not the individuals involved. Overall, the system removes the pressure of bottom-line results and has generally been seen as conducive to waste.

## III. THE SUBSIDY EXPERIENCE

The breadth of purpose, types and effects of subsidies outlined in the previous section makes a general description of subsidy programs difficult. Therefore, while certain themes are relevant across the modes of transport, a modal approach is used to review the role of subsidies in Canadian intercity passenger transportation.

## HIGHWAY TRANSPORTATION

Since the automobile dominates intercity passenger transportation in Canada, its use must be given careful consideration by the Commission. Relatively small percentage changes in car use can have large absolute values and large potential effects on other modes which are small by comparison. Therefore, the first part of this discussion deals with issues of the provision of highways and of automobile use in general. Characteristics of subsidies involving buses are considered separately.

The discussion does not deal at length with the operation of trucking, although the efficient provision and pricing of roads for passenger transport is unavoidably linked with the efficient use of roads by trucks. The linkage between freight and passenger services must be dealt with by the Commission in each mode of transportation.

### Highways and the Automobile

The major component of the transportation system is under provincial not federal jurisdiction. This began in the 19th century when highways were perceived as local in nature and so came under the provinces. Roads under federal jurisdiction are still few, for example, roads in national parks and roads which are a part of federal port or airport complexes. There are only two examples of national highway programs: the Trans-Canada Highway and the roads-to-resources program of the 1960s. The effect of segmented jurisdiction among the modes of transportation is a particular issue that the Commission must address.

The early development of roads was the responsibility of the local community through the use of statutory labour. Local roads were important for property access. Early trunk roads, needed chiefly for defence and the administrative of justice, were considered a public charge. Some turnpike roads were allowed, as in the United Kingdom and the United States, but toll collection delays were of concern in the provincial road systems. Tolls were not practical for roads used dominantly for access to property.

Consequently, the pattern grew up of financing roads from general revenue, with only a share of the revenue coming from users. For many years, about two thirds was collected from users in most provinces, in the form of licence fees and fuel taxes. Fuel taxes, which provide the bulk of revenue, were seen as user-fees varying with use, both by mileage and vehicle weight. However, the increasing fuel efficiency of large trucks with diesel power and improved engine performance have offset higher taxes for diesel fuel. In several American states, a weight-distance tax has been introduced to increase the revenue collected from large trucks.

Governments have found that fuel taxes are an excellent way to raise revenue. In addition to provincial taxes, which now approximate provincial expenditures on roads, the federal government levied an excise tax on fuel, and some local communities levy a transit subsidy tax on fuel. Total taxes paid by users in forms traditionally regarded as user-fees, now exceed highway expenditures.

Thus, taxes on fuel may have various purposes: to increase the cost of highway transportation to reflect some road costs and, thereby, to place road use, in aggregate, at a more efficient level; to act as a "pollution tax" on fossil fuel use (in transportation); to encourage a shift from automobile travel by raising its costs and, possibly, using the resulting revenue to subsidize alternate transport services; to serve as a source of general government revenue.

The latter objective appears important to the federal government. It may cause the Commission to consider the economic, social and political ramifications of policies which identify transportation, like tobacco and alcohol, as a source of high contribution to general revenue. It is interesting that the government may now see transportation as a special source of general revenue, even though, during the development of the country, special attention had been given to reducing the costs of overcoming distance. The taxes affect transportation as both an industrial input and a consumption service.

Unfortunately, the simple comparison of highway tax revenues and expenditures does not adequately compare revenues raised from users with the value of the road resources they use. Annual tax flows measure revenue; that portion (of provincial charges, especially) above normal taxes might be regarded as a user-charge. However, highway expenditures on maintenance, operations and capital are not accurate reflections of true, aggregate highway costs. They ignore the cost of capital, and do not reveal whether capital is being consumed by inadequate maintenance and replacement or being built up by advanced construction. The 1989 study by the National Highways Policy Steering Committee suggests a substantial under-investment in highways.

The current method of financing highways is associated with a number of issues:

- What is the relationship between vehicle types and road costs?
- Would the supply of highways be more efficient if user fees were placed in a dedicated highway fund?
- Do fuel taxes result in user-fees less than or more than relevant costs in aggregate?
- How do costs and revenues compare by road type and by type of user?

As the Canadian transportation system matures, the major issue that has emerged is the efficient use of roads. The most frequently expressed concerns revolve on questions associated with the allocation of costs among users. What wear and tear are associated with which vehicle types, and do vehicle types pay for their share of road costs?

However, issues of paying for the existing system are only part of the picture. How to avoid excessive congestion? How to provide the right highway capacity? These questions are prominent because of the need for different approaches to the cost of additional highway capacity. They arise because of the general absence of road pricing — there are few toll roads.

Fuel taxes raise revenue for governments and they raise vehicle operating costs. However, they apply system wide and do not reflect the costs of specific facilities. While the appropriateness of user-fees on low-density main roads is an issue, the paramount issue for the Commission is the supply of roads to meet the demands of high traffic.

The cost of additional traffic on high-volume roads is high for two reasons. First, the traffic imposes congestion costs on the system. Second, the relevant cost of accommodating more traffic becomes not just the wear and tear on the existing highway but the cost of providing new capacity. The absence of specific road pricing systems results in the absence of the usual measure of the need for new capacity, that is, consumers paying the price. For highways, the volume of traffic on routes is in response to the general regime of highway finance, not the cost of specific routes. The cost of new roads is much higher than the cost of existing routes. Highway users should be prepared and expected to pay the high cost of new roads.

Ensuring that highway users bear the real cost of high-volume routes is a major concern in many countries. Electronic technology is creating new opportunities to introduce road pricing. However, even traditional toll systems are being reintroduced, for example, the Coquilhalla Highway in British Columbia. The economics of road pricing require careful consideration by the Commission.

Not only does the provision of additional highway capacity need much capital, it will also have important implications for the demand for public transport services. Because of the large volume of car travel, a small percentage change can have major implications for the size of public transport.

### The Bus Industry

The bus industry is affected by a number of issues similar to those of automobile users. These include the level of highway taxes; the sharing of highway costs among users; and efficient approaches to traffic congestion. Intercity services are affected by urban traffic as well as trunk road conditions. However, the bus industry stands to benefit from a finding that automobile (and truck) traffic is not making sufficient contributions to counteract the cost of highway congestion or to investment costs.

The development of bus services has also been influenced greatly by provincial regulation, which remained unchanged even with the passage of the NTA, 1987. Provincial governments have licensed major carriers who then were expected to cross subsidize services to small communities with the profit from major routes. It is not evident that the program has been successful. The regulated regime may have inhibited technology and service improvements, while returns in the industry were quite high. Today, increasing competition is making cross subsidy impractical.

The position of the bus industry could be significantly affected by an integrated passenger policy dealing consistently with all modes of transportation.

The regulation of the bus industry seems anomalous. The favoured position of VIA for subsidized passenger services needs review.

## RAIL SERVICES

Rail passenger services in Canada have deteriorated over the last 40 years in the face of increased competition from automobile and air transportation. In spite of occasional, well-intentioned initiatives by railway managers and governments, the contribution of rail services has declined.

Symptomatic of the problems of passenger service has been the lack of clear statements about the purposes to be served by rail services. In 1967, an amendment to the *Railway Act* provided that railways would receive compensation for 80 percent of losses approved by the Canadian Transport Commission. The incentive left with the railways to diminish the losses did not have the effects the government had hoped. CN introduced marketing initiatives which stimulated some traffic, but mounting losses and dissatisfaction led to the formation of VIA to take over the intercity passenger services of CN and CP. The passenger services provided into northern Ontario by the Ontario Northland Transportation Commission and Algoma Central continue to be subsidized under the *Railway Act*.

VIA has not been given a clear mandate, nor are the reasons clear for operating specific services. Faced with operating services at a heavy loss, VIA has attempted to increase occupancy by using discount fares which reflect the incremental cost of (subsidized) seats otherwise remaining empty. The resulting low fares led to complaints from the Montreal-based bus line, Voyageur Colonial Limited, and hearings before the National Transportation Agency. The second set of hearings was terminated following appointment of the Royal Commission. Figures such as the subsidy per passenger on routes are available but they have not been used in conjunction with detailed passenger profiles nor compared systematically with the cost of providing services by other means. While the subsidies for VIA are explicit, the reasons, effectiveness and incidence of them are obscure and muddled.

## AIR SERVICES

Three types of subsidies are found in air services: incomplete cost recovery, payments for unremunerative services and cross-subsidized airline services. The main subsidies have been created by partial cost recovery.

The contributing factors to this are a scarcity of cost-recovery initiatives — for example, in connection with air navigation services; low traffic volumes at many airports; a national, uniform and inefficient system of landing fees; and limited innovation in airport development and in pricing airport services. Those matters are being addressed currently in the context of the cost-recovery initiative and airport reorganization.

It should be noted that an important issue in the proposed scheme of user-charges is the extent to which charges are designed to achieve cost recovery rather than efficiency. Other issues are whether funds should go to general revenue or an aviation fund, what role new airport authorities may play in the national system and whether air services are to be funded as a system or whether individual airports are to be treated separately.

Although aviation comes under federal jurisdiction, the provinces provide subsidies of two types. Some provinces, such as British Columbia, fund remote airports; others, such as Ontario and Quebec, support services to remote communities. In Ontario, the services are provided on an operating contract basis for the Ontario Northland Transportation Commission. They are not tendered services as would be required under the NTA, 1987.

Before airline deregulation, it was expected that national carriers, especially Air Canada, would provide some unremunerative services to small communities. Meeting this public service obligation was a responsibility that Air Canada accepted. When the forces of competition made cross subsidy impractical, the public responsibility was a concept that some managers (as well as some politicians) were slow to give up. However, innovation under deregulation has resulted in more frequent services to such small communities but with smaller aircraft matched to traffic volumes and operated by regional rather than national carriers, or by regional subsidiaries of the main carriers.

## MARINE TRANSPORTATION

Large subsidies are provided for ferry services in Atlantic Canada as a result of constitutional obligations. In British Columbia, ferries are primarily a provincial responsibility, although a modest federal subsidy is provided for remote services.

The level of service and financial performance of ferry services are affected significantly by the seasonality of vacation travel. Explicit policy statements about the level of services and expected cost recovery from tourism and other major traffic segments apparently do not exist.

Where ferry services are short, as in river crossings, they may be treated as parts of provincial highway systems. These services may be provided without charge.

Although marine services can be costly for taxpayers, they do not appear to be controversial at a national level. Two conditions may account for this. First, the main need is constitutional in nature. Second, they have little effect on other modes.

## IV. ASSESSMENT

Subsidy programs have evolved in the individual modes of transportation in keeping with traditional practice. No coherent approach to the roles of the modes and of the subsidies affecting them is emerging. Notwithstanding the overall policy statement in section 3 of the NTA, 1987 applicable to passenger transportation, the reality is that modal behaviour has simply evolved in a fragmented way.

### MODAL SERVICES AND SUBSIDY TYPES

Subsidies are provided in transport under each of the categories recognized in Section II of this paper. However, there is significant variation across the modes. Exhibit 4 is a summary of subsidy types by mode.

*Exhibit 4*
*SUMMARY OF SUBSIDY TYPES BY MODE*

| | Payment | Provision | Protection | Absorption |
|---|---|---|---|---|
| Auto | — | Yes | — | Yes |
| Bus | Minor | — | Minor | — |
| Rail | Yes | — | — | — |
| Air | Minor | Yes | (ended) | Yes |
| Marine | Minor | Yes | — | — |

**Automobile**

Subsidies provided to the automobile are the least well understood. This itself is a major problem, because they are hidden in society's absorption of environmental costs and in the public provision of roads.

The technical amount and economic significance of the environmental costs absorbed by society are important issues in our time. They are slowly being addressed by environmental control measures. Such direct measures are appropriate. While the magnitude of the environmental effects of the automobile are uncertain, their existence is not doubted. The general types of response warranted are known. The environmental literature deals extensively with the role of regulations and taxes to mitigate pollution effects efficiently. Pollution is best dealt with directly, not by subsidies to alternative modes.

The most controversial highway subsidy issue is whether travellers collectively pay for highways. An equally thorny question is which parts of the highway network are subsidized. Presumably low-density roads are subsidized; this is not at debate. It can be justified on two grounds. First, these highways provide basic mobility and access, partly funded out of property taxes. Second, the subsidy can be justified economically when the cost of automobiles on roads with limited traffic is low.

The main highway issue is whether users are subsidized by the provision of high-capacity roads. This may be viewed in another way: Are users actually willing to pay for upgraded roads? (Highway users are always anxious to see road improvements which save them travel time and operating costs; they get more and pay less.) The most effective policy mechanism to deal with the issue is a move in the direction of road pricing.

Road pricing provides an opportunity to move away from the supply-driven policies of the past to those in which demand plays a prominent role. "Pay for growth" is a politically saleable principle. Electronic technology is facilitating more complex road pricing schemes than would have been possible otherwise. However, simple approaches can also work — witness toll roads and the Singapore "road pricing" system.

Effective road pricing would have the desired effect of enabling transportation costs to be seen more clearly by travellers. The commercial prospects of public transport services would thus be enhanced. (The level of road charges in Japan and Europe certainly contributes to the viability of rail services.)

**Bus Services**

Bus services are provided with some intercity subsidies for unremunerative services, for example, in Newfoundland. However, the main issue in the bus industry is the hidden effects of regulation, retained, in part, to maintain cross-subsidized services. The record in other countries and in Canada suggests that cross subsidies are not sustainable, do not provide services best matched to small community conditions, and lead to less innovation and efficiency in protected services. Cross subsidization has none of the attributes of a good subsidy program, but tendered services would be possible and appropriate. New mechanisms of grants to those needing travel assistance could also be used.

**Railway Services**

While railway services have the merit of being subsidized mainly through explicit payments, the program is bogged down with historical legacies.

The first is our love of trains. It is necessary to recognize that the purpose of subsidies is not to subsidize trains but to subsidize particular passengers. Can better methods be found to do this? To answer this, it is necessary to have more precisely articulated statements of the objectives of subsidies and to have better information on train users. Data on subsidies per passenger are known, but who are these passengers? How many people, as compared with trips, are subsidized? How many tourists? If passengers were given the dollar subsidy implicit in rail use, what mode of transport would they use?

The second legacy is the reliance on a single main provider, VIA Rail, which is handicapped by the lack of a clear mandate. The innovative approach to tourist service between British Columbia and Alberta is evidence of the innovation possible under an alternate policy regime. If subsidy objectives are defined more precisely by route, could subsidy levels and delivery mechanisms be developed more selectively and precisely? Should tourists be subsidized to the same extent as those travelling on "essential" services? Are similar services required across markets? Should services be provided by a single supplier? To what extent can competitive tendering and service contracts be used?

Rail services have also been impeded by the hidden subsidies seemingly enjoyed by highway users in high-density corridors and by air travellers.

### Air Services

Air services have had subsidies in most categories. The regulation that enabled cross subsidies for unremunerative services has ended. The environmental effects of air services are most evident in noise pollution around airports. In Canada, affected property users have, generally, not been compensated as they have been in some countries. In Japan, for example, compensation has been provided to property owners for soundproofing buildings. In Edmonton, property owners adjacent to the city airport have been given a reduction in property taxes. However, compensation does not remove the subsidy to the air services unless the revenue is raised from them.

The noise frequency at airports is increasing because airport traffic is growing. However, the introduction of new third-generation, quieter aircraft, is greatly reducing the area of the noise imprint of flight paths and reducing noise levels within the affected areas.

Since noise pollution caused by air services continues to be dealt with by regulations on aircraft operations, some inefficiencies may result from excessive or too low standards. However, change to a system of industry payment and compensation for those affected is a change that goes beyond transportation to compensation in society generally.

The subsidization of air services through less than full cost recovery for airport and navigation infrastructure and services is being addressed in the current cost-recovery initiative. This program raises questions about the extent to which efficiency and cost recovery can be achieved; economic efficiency may require deviation from annual accounting cost recovery. The complexity of efficient user-charges has led to special studies of the subject. It has raised questions, also, about the extent to which airports should be treated as parts of a system to be financed collectively.

No air services are provided under subsidy under the NTA, 1987. However, some services to remote communities are subsidized by provinces. In Ontario, for example, the Ontario Northland Transportation Commission has provided services through norOntair since 1973. norOntair continues to serve a mix of profitable and unprofitable northern routes, and receives an *ex ante* negotiated subsidy. Several provinces provide emergency air health-care services under contract with private operators.

### Marine Services

Marine services are subsidized primarily through Crown corporations which operate at a loss. The largest losses are incurred on federal services in Atlantic Canada. The services vary by community type and traffic type, and communities vary from small and remote to large urban areas. Passengers, which include residents and business people travelling occasionally, commuters and tourists, exist in different proportions on different routes. As with rail services, the rationale and amount of subsidy incurred on behalf of the individual groups remain unclear.

Some ferry services are provided without charge as a part of a provincial highway system. While these generally are for river crossings, the apparently arbitrary distinction between services provided free and those for which there is a toll gives rise to controversy.

## COMPARISON OF SUBSIDY PRACTICES AND PRINCIPLES

There is a significant contrast between the principles recommended for the management of subsidies and the attributes of subsidies found in Canadian passenger transportation. An important contribution to the effectiveness of passenger transportation in Canada would be to bring about a greater coincidence of actual with recommended practices.

The reasons for the gap between reality and recommendation are not hard to find. First, Canada started by using transport as an instrument of nation-building. Subsidies for the construction of roads and railways were to meet the basic community needs of mobility for defence and justice as well as of trade. In spite of changing needs, practices have not changed.

Second, the nature of transport services has involved government in ways that hide subsidies. These include the public provision of facilities and services, as in public roads, airports and ports, and in the regulation of for-hire services.

Third, the limited role of competitive markets has restricted the influence of commercial pressures. Disciplines of the market have been stronger in the freight mode.

Finally, politicians have an understandable but unfortunate reluctance to reveal the level and incidence of subsidies for fear of upsetting their constituents.

The desirable attributes of subsidy programs are:

- Provide subsidies as directly as possible to the intended beneficiaries;
- Provide subsidies in ways that do not distort competition;
- Avoid subsidies which distort input prices;
- Make subsidies transparent, that is, visible and with a clear purpose; and
- Monitor and publicize results.

The most important of these attributes is that subsidies be transparent, a quality that is essential for effective monitoring. Clarity of purpose must go beyond statements of provision of service to a particular community and measures of total ridership, revenues and costs. It must identify particular types of users and beneficiaries.

Detailed technical studies on the effectiveness and incidence of specific passenger service subsidies would be pathbreaking. They would make contributions comparable to the grain costing work of the MacPherson Commission, which provided an example of technical analysis and provided a basis for important policy recommendations.

The attributes of desirable programs do not point directly to one type of subsidy over another. However, the nature of subsidies as they exist in Canadian passenger transportation suggests that those which are least likely to meet the desired criteria are absorption and protection, followed by subsidies through the provision of facilities and services without full cost recovery. The payment method of subsidization is likely to be able to meet the criteria. Unfortunately, as practiced in Canada at present, it does not do so.

The absorption of costs is undesirable as it encourages the inefficient use of resources. In transport, it is mainly associated with environmental effects which are being dealt with directly, albeit late and slowly.

Subsidies by protection, such as in bus services, are hidden, often ineffective for those subsidized and result in less efficient services overall. Subsidized services would be more effectively provided if service contracts or competitive tendering arrangements were used. The extent of competitive tendering may be influenced by the market structure and policies respecting Crown or private operations. Increasingly, the latter is preferred and competition more likely. The provision of direct "payment" to travellers may also be considered.

The provision of infrastructure by governments creates situations in which subsidies may be hidden and purposes unclear. Less than full cost recovery for low volume airports or roads may be efficient and consistent with other policy objectives.

Subsidies may exist also in the provision of intensively used facilities. Congestion costs and the high cost of new facilities must be considered. The similarity of the economically correct policy of having users pay marginal costs with the politically acceptable policy of users "paying for growth" may provide an important basis for policy recommendations. This principle may be particularly helpful in advancing the case for more direct charges than fuel taxes for roads with high traffic volumes. Various schemes are making road pricing a realistic option for the future.

User-fees designed to raise the level of cost recovery will likely raise concern for the efficiency with which facilities are currently used. That is good. For example, the increase in user-charges for air and sea modes has raised awareness about the inefficiency of supply of facilities for those modes. A similar response from road users would probably increase interest in the more efficient use of road space, for example, by high-occupancy vehicles.

The development of new policies for user-charges raises questions about the use of dedicated modal funds. Such funds would not be recommended in theory, but perhaps they are desirable in practice. It should be noted that the discipline that such funds create may not be liked by politicians!

The payment of subsidies to VIA is the most visible passenger subsidy in Canada. The program does not meet a number of criteria for a desirable subsidy program. The target travellers are not identified clearly so that results cannot be measured effectively. The subsidy distorts competition among modes by being provided to a supplier, VIA, rather than to travellers. Competitive tendering of the transportation services does not take place.

Overall, the provision of subsidies in Canadian passenger transportation has evolved over time and under different governments without a coherent framework to ensure that the subsidies would work to achieve a safe, adequate, economic and efficient transport system making the best use of all modes of transportation. A significant shift in subsidy practice is needed to achieve the overall policy goals.

Current practices and policies reflect the historic need for governments to ensure the provision of basic infrastructure and services to build a new nation. Attitudes and institutions have not yet adapted to the requirements of a mature nation in which resources must be allocated among alternate programs, including coping with congestion and expansion. The implication is that less attention should be given to engineering-driven supply initiatives and more attention given to demand-side elements. This includes a stronger role for market mechanisms, such as cost recovery, including road pricing, and a greater attention to particular travellers for whom assistance may be warranted. The desirable attributes of subsidy programs outlined previously are consistent with these recommendations.

Passenger transportation policies in the future need to provide a long-term vision which can guide the development of promotional policy based on the requirements of a mature economy. This shift will be as significant as the change achieved in regulatory policy since the MacPherson Commission first recognized the need to respond to the changing role of competition in transport markets.

## ENDNOTES

1. Organisation for Economic Co-operation and Development, *Transparency for Positive Adjustment: Identifying and Evaluating Government Intervention*, Paris, 1983, pp. 32–33.

2. Ibid., p. 249.

3. Rachel E. Kranton, *Pricing, Cost Recovery, and Production Efficiency in Transport: A Critique*, Infrastructure and Urban Development Department, The World Bank, Working Paper 445, Washington, D.C., 1990, p. 45.

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## 6

# TRANSPORTATION INFRASTRUCTURE POLICY: PRICING, INVESTMENT AND COST RECOVERY

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## 1. INTRODUCTION

Transportation policy issues were, for much of the last several decades, loosely integrated with national and regional economic policies in Canada. Transportation was viewed as a tool of government to promote the economic development and growth of different regions, groups and industries. This position changed somewhat with the passage of the *National Transportation Act* (NTA) of 1967. Based on recommendations of the MacPherson Royal Commission, the Act broke with tradition and established the policy that efficiency within the transportation sector was of fundamental importance in securing a firm foundation for the economic growth and development of Canada. To achieve this goal, competition among modes was selected as the mechanism. The MacPherson report also recommended that any region, group or industry deemed sufficiently deserving of subsidization was to receive direct payment rather than subsidization through the underpricing of either or both transportation services and infrastructure. This was generally adopted as part of the NTA of 1967.

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Since 1980, external and internal economic and political pressures have resulted in deregulation in the airline and trucking industries, the introduction of intra-modal competition and the privatization of carriers. This policy shift was formalized in the new *National Transportation Act, 1987* which took effect January 1, 1988.

Allowing market forces to determine the structure and behaviour of different modes (primarily carriers) has been the new policy direction. It has also meant a shift away from setting infrastructure prices below costs. Transport Canada's recent proposal of a cost-recovery policy for air and marine infrastructure is a small step toward this goal. A similar shift has not taken place for highways, likely because of the fractured jurisdictional responsibility for roads among the different levels of government. While air is the responsibility of a single agency (the federal government) highways are a combination of provincial, regional, county and municipal responsibilities with the proportions of roadway in each of these levels of government varying across provinces. This spread also characterizes the United States and distinguishes North America from Europe where there is more integrated transportation planning at the central level.

Over this same period, infrastructure policy has been subjected to a number of exogenous stresses including the Free Trade Agreement with the United States and the globalization of industries. Both factors have resulted in growth and shifts in demands which have generated pressure for additional and improved infrastructure as well as for new institutions to manage them. These demands come at a time of restraint with governments under severe economic pressures to be fiscally responsible. Governments are reluctant to commit themselves to significant expenditures even for maintaining the existing stock of transport infrastructure let alone adding to it.

Given the realities facing the Canadian economy, how should one establish pricing principles and investment guidelines which satisfy both the objectives of the *National Transportation Act, 1987* and the needs of Canada and the Canadian economy in the years to come? The fact of the matter is that transportation infrastructure, an important component of the nation's capital stock and an important factor in its economy and welfare, is a victim of both fiscal restraint and the failure to treat it as a scarce economic resource. In the past, transportation policy at all levels of government focussed on capacity expansion (supply) rather than the management of demand for infrastructure. Sensible policy reform must consider the costs imposed by users on the system and on others when using infrastructure, including congestion and other externality costs. Infrastructure shortages resulting from both underpricing and inadequate investment limit the realization of the efficiency gains promised by deregulation and privatization in the transportation sector.

Pricing and investment planning of Canada's transportation infrastructure cannot ignore the forces and pressures developing in the United States and other international markets. Links must be established between investment in infrastructure and the pricing of services delivered by that infrastructure. Indeed, socially optimal modal pricing requires the inclusion of modal air and noise pollution and congestion externalities. Congestion externalities are emphasized in this study but the models and concepts are applicable to air, noise and other externalities. Economic welfare will be lower if these factors are not considered in modal prices because demands for massive public investment in infrastructure will continue unabated, infrastructure will deteriorate prematurely, and the distribution of traffic across modes will not reflect the real modal costs. The solution is not necessarily more investment but rather smarter investment. Smarter investment must start with efficient pricing.

The main purpose of this study is to discuss the principles and methods by which Canada can ensure the optimal use and efficient provision of transportation infrastructure services in all modes of transportation. Emphasis is also placed on the cost-recovery issue. There are a number of reasons for this, including the fiscal constraints faced by government, the motivation to reduce the efficiency costs of financing infrastructure deficits through taxation and the general movement to decentralization.

Cost recovery is treated in two alternative ways. First, cost-recovery conditions associated with optimal pricing and investment in infrastructure are studied and compared to the actual cost-recovery situation. Second, the methods of achieving an exogenously given cost-recovery target which minimizes efficiency loss is discussed. Although the principles and methods used can be applied to all modes of transportation, the emphasis of the discussion (with empirical examples) is on roads and airport infrastructure. The study also emphasizes that allocative and productive efficiency gains are not accomplished through simply financing a cost recovery but rather through achieving cost recovery with efficient pricing.

Section 2 presents a survey and assessment of the principles and alternative methods of infrastructure pricing. It includes a discussion of the potential difficulties for implementing some of the ideal principles. Also reported are the empirical results of some studies which apply the optimal pricing principles. Section 3 examines the literature on cost structures for transportation carriers and infrastructure providers. The focus is given to the empirical results on economies of scale, traffic density and scope. An analysis of the optimal user-charges for airports and roads is presented, and some suggestions for achieving the optimal cost-recovery targets are made in Section 4. This section also reviews current user-charges and cost-recovery status by major user-groups in both air and road modes. Alternative sources of financing road infrastructure currently in use are examined and discussed in Section 5. A summary of the findings is given in Section 6.

## 2. INFRASTRUCTURE PRICING: THEORY, ISSUES AND APPLICATIONS

This section presents a survey and assessment of the principles and alternative methods of infrastructure pricing. Although it addresses infrastructure pricing principles, the characteristics and consequences of each pricing principle will also be discussed in a general framework for all goods and services. Potential difficulties in implementing some of the ideal principles are identified and discussed. The empirical results of some studies which apply the optimal pricing principles are also presented.

### 2.1 THE ROLE OF PRICES AND WELFARE

Transportation infrastructure is like any piece of capital — it represents a stock which yields a flow of services. The services from infrastructure, such as roads and airports, reflect economic scarcity because their construction and continued servicing require the use of scarce resources. Concern about the efficient use of resources in the economy necessitates finding some mechanism and criteria to determine both the distribution of resources between transportation infrastructure and other parts of the economy and resource distribution among modes within the passenger transportation sector. How many miles of roads should be built? How many airports? How big should they be? These, among others, are questions which pricing principles seek to answer.

There are essentially two perspectives as to how to answer these questions. One is the market approach. It uses the price system to allocate scarce resources to their most valued uses on the basis of willingness to pay. If the market mechanism is to be used as a method of maximizing social welfare, all private and p[illegible] goods and externalities (such as air or noise pollution and congestion) must be "valued." This value or price should reflect the resources used and be a measure of the cost to produce the good or service. This cost is to be the marginal cost, and no buyer or seller of a good or service should have sufficient power to drive a wedge between the price charged and the marginal cost of production. These conditions assure maximization of allocative and productive efficiencies or, equivalently, of social welfare. Allocative efficiency is the measure of performance of scarce resources allocated to end uses, goods and services, that best accords with the pattern of consumer demand. Allocative efficiency is at an optimum when the price of each product equals the lowest resource cost of supplying the marginal unit of the product. Technical or productive efficiency refers to the minimum cost of producing a given output.

The other approach to resource allocation is to use direct planning methods characteristic of some centralized economies and which include the use of various non-market mechanisms. These non-market mechanisms can take a variety of forms including administrative rationing, random allocation and queuing. Some authority must decide how to allocate available goods or services to competing uses and choose the goods and services to produce. However, since there is no efficient method of inducing users to reveal their preferences, the authority has no way of accurately knowing who values a given good or service more. Consequently, the authority may end up providing a good or service to those who do not value it the most. This can lead to significant allocative inefficiency. In most cases of direct market intervention, the objective is rarely to improve efficiency. Efficiency costs, however, are still important as measures of the costs of abandoning a market approach. Furthermore, because there are no signals for the capital market, there will not necessarily be an optimal investment in capacity, except by chance.

In a market economy, prices perform two functions. In the short run, they act as a signal to ensure that scarce goods and services (airport capacity, for example) are allocated to those who value them the most. This ensures that the social benefit, from the utilization of the fixed capacity, for example, is maximized. In the long run, prices provide a signal to the capital market to move capital into those activities which yield the highest return, and thus guarantee an optimal investment in capacity.

Given the different outcomes associated with the alternative policy proposals, efficient pricing or non-market mechanisms for resource allocation, one must use some criteria to assess their relative merits. Economists have generally not considered both economic welfare *and* income distribution outcomes when evaluating alternative policy proposals or pricing methods. The level of economic welfare is defined as the sum of consumer surplus and producer surplus. Consumer surplus is the additional value a consumer derives from consuming a good or service over and above the price paid and is generally measured by the difference between the value revealed by the demand curve and the price paid. Producer surplus is a producer's net revenue over and above the cost of production. A dollar saved by a low-income person is regarded as having exactly the same value to society as a dollar saved by a high-income person. This means evaluation of alternative policy proposals or pricing methods by the welfare criterion alone ignores the income distributional consequences. In other words, an economic reorganization or change is considered beneficial if those who benefit collectively gain more than the total losses incurred by those who lose. Use of this welfare criterion alone is based on the compensation principle which implies that those who gain can compensate those who lose without incurring any redistribution costs. Although the change in the level of welfare (economic efficiency) is generally regarded as more relevant for evaluating policy, the effect on income distribution cannot be ignored because, for most cases, income redistribution is not without cost. The various pricing principles and non-market allocation procedures reviewed are judged primarily in terms of their consequences on economic efficiency (welfare). Attempts are made, however, to make a preliminary assessment of the consequences of some pricing principles for income distribution (fairness).

## 2.2 ALTERNATIVE PRICING METHODS

Pricing is a method of allocating resources. There is no such thing as the "right" price irrespective of issues and objectives. Rather there are "optimal prices" or pricing strategies with particular objectives to be achieved. Prices can be established to maximize profit, welfare or revenues. They can be used to achieve a particular share of the market or a desired distribution of demand across products (for example, mode-split in transportation). From a society's viewpoint, however, one of the most important goals for pricing goods and services is to maximize economic welfare by optimally allocating scarce resources and goods or services across competing needs in the short run and to ensure optimal investment in capacity in the long run.

Much of the discussion and debate surrounding the pricing of runways and roadways seems to confuse efficient pricing and cost recovery or financing. Pricing transportation and financing transportation are very different concepts. Financing requires only knowledge of costs, and user-charges are set to achieve full or a desired level of cost recovery. Pricing, on the other hand, requires knowledge of both demand (which provides a measure of economic value) and costs since pricing tries to optimize the use of the resource and to balance the revealed value of transportation with the resource cost of providing it. In analyzing various pricing strategies it is, therefore, essential to have a clear understanding of various cost concepts since each pricing principle is related to a specific concept of cost.

Before proceeding with the detailed discussion of the various pricing methods, it is important to clarify the use of subsidies from general revenues to meet revenue shortfalls under some pricing approaches. There are two points. First, it has been argued that any deficits resulting from marginal cost pricing be financed from general tax revenues. Second, it is also argued that full cost recovery is not desirable if it results in prices that do not reflect marginal costs. First-best pricing has prices equal to marginal cost and second-best pricing has prices which deviate from marginal cost in a way which minimizes efficiency losses. Both arguments have an implicit assumption that the efficiency loss is less from raising a dollar for general tax revenues than by raising revenues in a specific market. This is not necessarily true. Jorgenson (1992) noted that the cost of public funds is indeed high. He reported on research by Jorgenson and Yun (1990) which shows that the marginal cost of a tax dollar is $1.46. In other words, for every dollar of public spending, the cost is $1.00 in tax revenue and 46¢ of loss in efficiency of the private sector. Ballard, Shoven and Whalley (1985) produce a marginal cost of $1.33. These numbers seem to justify a lower level of subsidy to some transportation modes than is implied in the current transportation literature. In essence this means that, with a subsidy from general revenues, second-best pricing may result in a lower efficiency loss than does first-best pricing.

The following subsections describe various types of pricing which may be relevant for transportation infrastructure pricing. These are: average cost pricing, marginal cost pricing, social marginal cost pricing, Ramsey quasi-optimal pricing, peak/off-peak pricing and multi-part pricing. They are followed by a subsection on allocation by non-market mechanisms, such as slot allocations at airports.

### 2.2.1 Average Cost Pricing

The average cost price is obtained by taking total costs and dividing them by the relevant measure of output. For example, if total annual airfield costs are $1 million, and if 10,000 landings per year are expected, then the landing fee would be set at $100. If price is set equal to average cost, total costs will be recovered. Average cost pricing is sometimes termed "full cost pricing."

If an industry's production technology is not characterized by constant returns to scale over the relevant range of output, average cost pricing leads to economic inefficiency by making the value (to society) of producing another unit deviate from the cost of producing it (that is, marginal cost). It is easy to demonstrate that if average cost is falling (increasing returns to scale), setting price at average cost lowers economic well-being due to the underproduction of services. Producing an additional unit of output at a cost equal to marginal cost and selling it for a price that exceeds marginal cost (but is less than average cost) could provide an increment to profit and potentially make society better off. Average cost pricing prevents such a desirable action from occurring.

Unless constant returns to scale prevail in the relevant range of market demand, average cost pricing leads to an incorrect level of output, both in the sense of social well-being and in the sense of profit maximization. Thus, except in the special case of constant returns to scale, average cost pricing is not a desirable basis for establishing a pricing strategy.

### 2.2.2 Marginal Cost Pricing

Marginal cost pricing maximizes the economic benefit to society by ensuring that a socially optimal volume is traded in the marketplace, and the optimal quantity is allocated to those who value it the most. Since marginal cost pricing maximizes social benefit without any constraint, it is often referred to as "first-best" pricing. For transportation services, this means that the service output is extended to the point where the marginal cost of serving an additional unit equals the price the user is willing to pay for the service. This marginal cost can be quite different from the average cost of production. Suppose for example, that the total cost of servicing 100 aircraft movements is $1,000 and servicing 101 movements is $1,005. This means the average cost of servicing 100 movements is $10, but the marginal cost of providing an extra movement (when the current service level is 100) is only $5. Average cost pricing would set the price at $10 per movement, while marginal cost pricing would set the price at $5 (for all movements). This pricing principle resolves the problems of inefficient production and consumption associated with the average cost pricing principle. Under conditions of constant returns to scale, unit costs are not rising or falling in the relevant output range. In this case, marginal cost equals average cost. Thus, marginal cost pricing and average cost pricing would be the same.

When unit costs are either rising or falling, average and marginal cost pricing strategies produce different results. Preference is generally given to marginal cost pricing based on the assumption that the efficiency loss resulting from any deviation from marginal cost pricing is greater than the efficiency loss of raising revenue through taxation. While average cost pricing would always lead to a financial break even, marginal cost pricing would require a subsidy for a firm to break even in the case of a declining unit cost industry. This is because price (that is, marginal cost) will be less than average cost. Marginal cost pricing will result in break even in the case of constant cost and a profit in the case of rising unit cost.

Another problem with marginal cost pricing is in the difficulty of measuring appropriate marginal costs. In the case of average cost pricing, one simply sums all relevant costs, operating and capital, variable and fixed, direct and indirect, and divides the sum by the anticipated output level to obtain price. For marginal cost pricing, however, it is not easy to identify the costs which vary with output even for the case of a single product. For instance, capacity costs may be fixed in a very short run but may vary over a longer run. Therefore, the measure and variability of marginal cost will depend on the time frame one chooses. This study argues, and this is the consensus in the literature, that the short run is the appropriate time frame for establishing efficient prices.

### 2.2.3 Social Marginal Cost

When the production or the use of goods or services results in negative (positive) externalities, such as the imposition on others of noise or air pollution or congestion delays, social marginal cost deviates from private marginal cost (cost incurred by the producer or user). In this case, marginal cost pricing based on the private marginal costs will generate too much (too little) output compared to the socially optimal level of output. When this occurs, social marginal cost pricing maximizes welfare (economic efficiency) as it internalizes the externality costs in a user's decision making. Social marginal cost pricing extends the marginal cost pricing principle to the situation where externality costs exist. It recognizes the costs a user imposes on others (externality costs) in addition to the privately borne costs of the user. For instance, an extra vehicle that uses a congested highway imposes costs on the cars and drivers following it by imposing additional delay on them. It also imposes air and noise pollution. In the case of airports, a user of the airstrip may impose a congestion externality, as well as noise and air pollution costs. Social marginal cost pricing internalizes these externality costs by charging users the full social cost. By internalizing the externality costs, the user is induced to make decisions consistent with social benefit maximization.

The application of this pricing principle has been shown to result in the optimal use of a facility (given fixed available capacity) and in the optimal level of facility investment (see, for example, Morrison, 1983). From as early as 1920, this principle was presented in the context of transportation, specifically road congestion (Pigou, 1912; Knight, 1924). In 1961, Walters formalized the peak-load pricing work of Boiteux (1960) and Steiner (1967) using cost functions. About the same time, Strotz developed the same ideas but with the use of utility functions. The basic model has been elaborated upon and extended by numerous researchers including Mohring and Harwitz (1962), Vickery (1965, 1968), Mohring (1970, 1976), Keeler and Small (1977), DeVany and Saving (1980) and Jordan (1983a, 1983b). Morrison (1986) showed that the conventional homogeneous users model needs only slight modification to handle heterogeneous users.

### 2.2.4 Ramsey Quasi-Optimal Pricing

As discussed earlier, there are circumstances where marginal cost pricing would not be sustainable in the long run. For example, if the production function is characterized by increasing returns to scale, marginal cost is less than average cost and, therefore, total revenue would be insufficient to cover total cost. In this case, there are generally three options to choose from:

- use marginal cost pricing in conjunction with a government subsidy;
- use some form of second-best pricing, such as Ramsey pricing; or
- use multi-part pricing.

The features of Ramsey pricing are described below. Multi-part pricing is considered later.

Economists have demonstrated that a deviation from (social) marginal cost pricing may reduce social benefits and misallocate resources by over or underproducing the service. The essence of Ramsey pricing is to minimize the loss of economic efficiency caused by the deviation of prices from their respective marginal costs while allowing a financial break-even position to be achieved. Ramsey pricing makes use of an inverse-elasticity rule to mark prices up over marginal cost while ensuring that the quantity of service supplied deviates by the least amount from the optimal quantity under marginal cost pricing. In doing so, Ramsey pricing makes use of the willingness of the segments to pay. In other words, Ramsey pricing maximizes social welfare subject to the constraint that the firm achieve a break-even financial position. Thus, it is usually referred to in the literature as a "second-best" strategy.

The Ramsey pricing principle states that when a revenue constraint exists, the ratio of the markups (the excess of the selling price over marginal cost) must be proportional to the inverse of the price sensitivities for the product in question. In other words, the different groups of users may pay different prices depending on their own price sensitivity, even for an identical product or service. If applied to airfields, this might imply that landing fees would be dependent on the length of the flight, aircraft size or type of use because each of these (demand) characteristics can be expected to lead to different price elasticities of demand. A simple approach to covering the fixed costs is to charge all types of users an equal price which exceeds the price based on marginal cost pricing. Although simple, this approach is inefficient and leads to a larger loss of social benefit than the allocation based on Ramsey pricing. According to the Ramsey pricing principle, these fixed costs are recovered by allocating proportionally more of the fixed costs to those who have a lower price elasticity of demand than those with a higher elasticity.

Ramsey pricing relies on the existence of different market segments with a different willingness to pay for the same good or service.[1] Ramsey prices must cover variable costs. It minimizes the total loss of social welfare by allocating the excess of total costs over variable costs to various market segments. For Ramsey pricing to achieve social optimality, it is essential for the producer to have some market power; otherwise, the set of prices established under a Ramsey rule cannot be sustained.[2]

Ramsey pricing can be generalized as a method of finding the optimum set of prices under any revenue constraint. This constraint can take the form of being confined to a given level of subsidy, a requirement to break even, or even to achieve a surplus of revenues over costs of a given magnitude.[3] Whenever the constraint becomes non-binding, the set of optimal prices derived from Ramsey pricing will become identical to those emerging from marginal cost pricing.

### 2.2.5 Peak/Off-Peak Pricing

Peak-load pricing is a widely used method in pricing public utility services. Peak-load pricing means that peak-period users are charged a higher price than off-peak users. First, peak-load users impose higher costs on the service provider than do off-peak users because they generate the need for capacity expansion, and thus should be prepared to pay all of the capacity costs. Second, peak-period users may also impose congestion costs and thus should be charged their social marginal costs. Third, since peak-load users generally have less price-elastic demands than off-peak users, charging higher fees to peak-period users (who value the service the most) is consistent with the spirit of Ramsey pricing. In other words, Ramsey pricing serves as a rationale for peak-load pricing.

Whatever the economic justification chosen, the end result is essentially the same: charging higher fees to peak than to off-peak users. Charging higher prices to peak users enhances economic efficiency by inducing them to make rational choices as well as helping solve financing problems for capacity expansion. Finally, peak pricing is not, in principle, unfair or inequitable. It assigns costs to those who are responsible for them. It makes no economic sense to restrict the use of a facility in off-peak hours because all that results is underutilization of an existing facility. With socially efficient pricing, peak users are no worse off in terms of what they pay, provided there is a low off-peak price, and off-peak users pay at least their variable costs.

### 2.2.6 Two-Part Pricing[4]

Another approach which has been developed to price infrastructure and to recover fixed (including overhead) costs is to have a multi-part price. One part, an entry fee for access to a facility (or infrastructure) is fixed and confers the right to use the facility. A second part, a usage fee is a price per unit of use of the facility. A price per kilometre would be an example.[5] The intuitive appeal of the two-part price is the ability to distinguish between the value of the potential demand for access to use and the demand for the actual use of a product or network. The prices of access and usage must be correlated with the proportions of fixed and variable cost while at the same time satisfying a revenue constraint. A person can be charged an access fee even if there is no use of the system. For example, people may benefit from having a roadway because others can visit them. They may at some future date decide to use it, and it may reduce transactions cost to have continual access to a facility rather than to contract for access each time they choose to use it. The ability to match prices with demand, representing different valuations of access and of usage, results in a higher level of economic welfare than if only a single price is charged. Train (1991) summarizes a broad literature which demonstrates that a tariff structure with N+1 tariffs *will always* Pareto dominate a structure with only N tariffs when price exceeds marginal cost and marginal cost differs from average cost.

With a two-part tariff the level at which each part is set (and the ratio of the revenues from each of the two parts) depend on a number of factors. If the demand for access is completely inelastic, the ideal approach is to set the access fee equal to the fixed cost and the usage fee equal to the marginal social cost of use. In effect, the access fee acts like a lump sum tax. When access demand is price sensitive and therefore not independent of the level of the access fee, the access fee cannot be treated simply as a mechanism to cover fixed costs. Raising the access charge involves a loss in consumer surplus as well as revenue from usage because some consumers will choose to forego access to the service (phone line or vehicle licence, for example) in the face of the higher access price. First, as the access charge rises more users are foreclosed from the market. This reduces consumer surplus and revenue from the access charge, if access demand is at all elastic. Second, with fewer users the demand for usage declines; the demand curve shifts to the left. This means a lower level of consumer surplus and revenue from usage. This fact must be incorporated into the determination of optimal prices.

When the number of users of the network, facility or system is affected by the level of the access fee, the institution or authority which has been charged with the responsibility of setting the prices must balance the relative welfare gains and losses as the relative access and usage fees are raised or lowered. If the access fee is lowered to encourage more users, the usage fee must be increased to compensate for the loss in revenue. The amount by which it will have to be increased with the objective of maximizing economic welfare while covering all costs (breaking even) increases with the absolute access price elasticity of the number of users and decreases with the absolute usage-price elasticity of the amount of usage (Ng and Weisser, 1974).

The absolute and relative values of the two elasticities are important in determining the levels of the access fee and usage fee. The access fee does limit the number of users, and it covers some or all of the fixed costs. The usage charge allocates facilities while covering the variable and part of the fixed costs. If the ratio of fixed to total costs is high, it is desirable to have as many members as possible implying a lower access fee and a usage charge greater than usage marginal costs. However, this cannot continue unabated since as the variable charge is increased above variable costs both revenue and welfare are reduced. The ratio of revenue contributions from the variable charge to the fixed charge depends on both the relative and absolute values of the elasticities of access and usage.

When access demand is price sensitive and a financing constraint is in place, the Ramsey concept can be used to compute the second-best tariffs for access/usage services. The Ramsey rule leads to setting the usage and access fees above their marginal cost. Train (1991) derived the following Ramsey rule for determining the optimal access and usage fees that allow the firm to break even.

$$\frac{P_a - MC_a}{P_a}(\varepsilon_a - \varepsilon_{ua}) = \frac{P_u - MC_u}{P_u}(\varepsilon_u - \varepsilon_{au}) \tag{2.1}$$

In the equation a refers to access and u refers to usage. $\varepsilon_a$ is the elasticity of demand for access with respect to the access fee, $\varepsilon_{ua}$ is the cross elasticity of demand for usage with respect to the access fee and $\varepsilon_{au}$ is the cross elasticity of demand for access with respect to the usage fee. The rule in this situation states that the percent by which the access fee is raised above the marginal cost of access, multiplied by the "net" elasticity for the access fee, is equal to the percentage markup of the usage fee multiplied by the "net" elasticity of demand for usage. The practice of setting the access fee equal to zero and increasing usage fees above marginal cost, as is done for example at airports and electrical and gas utilities, is optimal only if the demand for usage is fixed and the marginal cost of access is zero. Usage demand is usually more price sensitive than access demand because usage is conditional on access. Some economic efficiency gains can, therefore, be expected if there is a move to some reliance on the access fee (Train, 1991).[6] Such a change has been introduced in New Zealand in the pricing of air traffic control services.[7]

A two-part tariff can be used if users are relatively homogeneous. It is possible, however, that a facility, such as a roadway or an airport, may have a number of groups of users and that preferences may vary significantly across groups of users. It may, therefore, be desirable to have the two-part tariff and access/users fees vary for these different groups. For example, some groups may have low access and high usage fees and others high access and low usage fees. Generally, welfare is improved by offering consumers a menu of choices of two-part tariffs.

In sum, when access demand is price sensitive, the optimal access fee is lower and the optimal usage fee is higher than when access demand is fixed.[8] Unlike the situation with fixed access demand, the first-best outcome is not attained when access demand is price sensitive and the firm is required to break even. The reason for this is clear. When access demand is price sensitive, the access fee cannot serve simply as a subsidy mechanism since it also affects access demand and, indirectly, usage.[9]

## 2.3 NON-MARKET MECHANISMS

In the absence of pricing mechanisms, there are non-market or administrative instruments which are used to allocate scarce goods and services and to undertake new investment to expand capacity. A variety of these have long been used for the allocation of goods, services and resources. These include administrative rationing, random allocation by lottery and queuing. Despite the variety, all non-market mechanisms share the common characteristics that they do not use prices to allocate resources, goods and services. The outcome of both the resource allocation and the level of investment bears little resemblance to what would occur with efficient pricing. Measured in terms of economic efficiency, such allocative mechanisms are not generally as good as those obtained through the market system.

In general, non-market methods lead to inefficient outcomes due to their inability to adequately distinguish between high- and low-valued uses. The prices individuals are willing to pay directly signal such values. The inability to distinguish between high- and low-valued uses often leads the non-market methods to allocate some resources to those users who do not value them as much as others or who do not value the product or service as much as it costs. This results in a reduced level of welfare for society as a whole. Another problem with non-market mechanisms is that there is no built-in pressure which signals optimal timing and amount of capacity expansion. As a result there may be too little or too much capacity. Finally, the lack of a "market discipline" can, and generally does, lead to higher costs than would otherwise be the case.

Administrative allocation has two additional problems. First, the allocative principle tends to be arbitrary and could change with the decision-making authority and the political climate. Second, the resulting allocation of slots or rights to use a facility at a given time could create some monopoly power in secondary markets (such as airline services) by restricting new entrants especially during peak times. In the case of market allocation, such discriminatory allocation problems do not arise as the prices are set to clear the market and optimal capacity is likely to be in place. The problem of restricting potential entrants becomes particularly serious when the allocation committees are controlled by the existing users as in the case of the airport slot allocation committees at major Canadian airports.

Social welfare can be enhanced by allowing slot sales after the initial allocation. Welfare is improved because those who value particular slots the most end up using them. However, this results in windfall income gains to those who are initially allocated the high-value slots. This creates a severe inequity problem. An alternative is to let the airport auction its slots so that it gets to keep the windfall income gains.

Either type of slot market also has the advantage of signalling to the airport when additional capacity should be added. When the slot price is greater than the cost of incremental capacity, then investment will make society better off.[10] Even competitive slot auctions, however, do not always guarantee that social marginal costs are being charged as bidders ignore externality costs.

## 2.4 POTENTIAL DIFFICULTIES OF IMPLEMENTATION

Thus far various pricing methods which may be applied to pricing transportation services and/or infrastructure services have been presented. Some potential and practical difficulties of implementing some of the pricing methods are identified and discussed in the following subsections.

### 2.4.1 Pricing a Single Mode Versus Several Modes

All transportation services are capable of being supplied by more than one transport technology or mode. Each mode has different costs and quality characteristics. One of the aims of transport policy is to implement appropriate charging schemes for different modes in order to maximize the overall economic efficiency of the transportation sector. For example, if certain buses, which compete with railways, pay more than they should for the costs they are responsible for, such as the use of highways, then this may lead to an inefficient allocation of passenger traffic between bus and rail modes. An efficient allocation of traffic among competing modes requires marginal cost pricing by all modes as this induces users to make "socially optimal" choices among competing modes.

Problems arise if marginal cost pricing results in deficits for one or more modes of transportation. In such a case, each mode can be subsidized from general tax revenue or, in principle, the combined deficit of all modes can be allocated using the Ramsey pricing method. The former solution may be impractical as governments try to become fiscally conservative. On the other hand, it is difficult to implement the latter as the application of the Ramsey method intermodally requires the centralized control of all transportation infrastructure by a single agency. Currently different levels of governments have jurisdiction over different modal infrastructure.

Even if various governments were to cooperate for the implementation of Ramsey pricing in a multimodal context, it would require knowledge of each mode's combined cost of modal services (for example, airline services) and infrastructure (for example, airport services) as well as price elasticities of the demands. To date, there is no definitive empirical work which examines the structure of the combined cost of service and infrastructure for any mode. This makes it difficult to actually compute optimal prices which maximize economic efficiency in the multimodal context (see Oum, 1981; Winston, 1985 for imperfect attempts for such computations).

### 2.4.2 The Indivisibility Problem — Lumpy Capacity Expansion

Typically, economists assume that capacity is divisible when they investigate optimal pricing, the provision of capacity and cost recovery issues. For example, Mohring and Harwitz (1962) and Mohring (1970, 1976) showed that optimal congestion toll revenue exactly equalled the capacity investment cost when highway construction (and expansion) was perfectly divisible *and* was characterized by constant returns to scale. The debate regarding the divisibility of capacity expansion, however, remains unsettled, and various theoretical results obtained under the assumption of perfect divisibility require some refinements for cases where capacity expansion is characterized by lumpy investment, such as airport terminals and runways, and expressways.

There are two opposing views in the road pricing literature concerning the divisibility of capacity expansion. Some economists believe that increases in road capacity are characterized by lumpy investments (Walters, 1968; Kraus, 1981; Starkie, 1982) while other economists argue that the capacity of a road can be expanded relatively smoothly by simply improving some design features or by improving the traffic control system. Kraus (1981) showed that the cost-recovery theorem of Mohring and Harwitz required modification under the condition of indivisibility of capacity construction and expansion. The financial performance of roads under optimal pricing and investment policy depended on the type of road: that is, high-capacity roads or low-capacity roads. He found that, in the case of major highways, the cost-recovery ratio was higher when indivisibility was taken into account than for the case of perfect divisibility.

Oum and Zhang (1990) investigated the long-run relationship between congestion toll revenue and the capital cost of an airport. Their model incorporated the lumpy nature of capacity expansion and the demand fluctuations within a given day and over time. They showed that the cost-recovery ratios realized under social marginal cost pricing and optimal investment depend on both the time pattern of traffic growth and the amount of initial capacity in place. The most significant of all empirical results, developed for Pearson International Airport, Toronto, was that the larger the existing capacity, the higher the ratio of congestion toll revenue to capacity expansion cost.

The assumption of divisibility of capacity construction and expansion affects the setting of cost-recovery targets and user-charges. The relevant empirical question is to what extent the less-than-perfect divisibility of capacity expansion makes the cost-recovery results deviate from the classic result of Mohring and Harwitz. No one has a definitive answer to this question.

These results reflect a general problem of pure marginal social cost pricing with fluctuating or changing costs. Prices will be less useful in acting as a signal to users and to capital markets if there are significant and frequent fluctuations in costs because there will be a higher variance and hence more uncertainty as to their value at any given time. Lumpy investment is not the only culprit in causing costs to fluctuate. Scope economies and capacity utilization economies also result in costs changing with output or investment levels and hence cause fluctuation in prices based on marginal cost. The prospects of cost recovery with socially efficient pricing depend on how costs change with expansion and contraction of output and capacity. Lumpiness in capacity growth results in fluctuating prices and may lead to over or underfinancing. An assessment must be made of the welfare costs deviating from strict social marginal cost pricing relative to the welfare gains arising from more stable prices which create less uncertainty and have lower transactions cost.

### 2.4.3 Infrastructure Pricing and the Issue of Equity

#### *Fairness of Efficient Pricing*

The economics literature is paying increasing attention to the consequences of selective pricing methods on the equity of various groups of users and non-users; that is, the income distributional consequences of a pricing method. Problems arise when a pricing method, which maximizes economic efficiency, does not necessarily yield what is considered a fair or equitable outcome. The most obvious case is the implementation of congestion (or peak-load) pricing for (urban) transportation. While the introduction of congestion tolls on urban roads would improve the efficiency of resource allocation, such tolls make those commuters with less-flexible work schedules (which some identify as low- to middle-income groups) pay higher congestion tolls while those with flexible work schedules (generally higher-income groups) may be able to avoid the tolls by shifting commuting time to off-peak hours. Peak-period prices for urban transit services have similar unfavourable impacts on income distribution.

Small (1983) investigated this issue and estimated the net effects of congestion tolls on income distribution. He found that in the absence of any redistribution of toll revenue, low-income groups lose more than high-income groups because the higher value of time savings by high-income groups more than compensates for the toll payment. However, when the way in which the toll revenues are spent is taken into account the distributional impact of toll charges changes. Small examined the income distribution effects of distributing toll revenues to reduce taxes, to subsidize transit or to be used in some other way. The results varied but the basic conclusion was that it is misleading to characterize a congestion or peak-load pricing policy as "regressive."

Peak-period pricing, deemed necessary to achieve the goal of economic efficiency, has been viewed as having negative income distributional effects among various users. Winston (1991) argued that congestion and peak pricing could benefit all income classes if the toll revenues were used to do any of the following: lower property taxes, invest in public transit or replace registration fees or fuel taxes. Therefore, as pointed out by Foster (1974, 1975), the effects of an infrastructure price, such as for a road, runway, or terminal, on income distribution depend on how the collecting agency uses the toll revenue. Congestion tolls and peak-period pricing schemes can be designed to improve both economic efficiency and equity among various groups.

### *Income Distribution Consequences of Ramsey Pricing*

Ramsey pricing allocates fixed or common cost on the basis of willingness to pay. This willingness is a measure of the value to the user and is measured by the price elasticity of demand. This pricing principle has been recommended in circumstances where full or partial cost recovery is desired for underutilized airports, roads and port facilities with economies of traffic density and/or economies of scale (see Morrison, 1982).

The Ramsey principle is used to change prices from marginal (social) cost in such a way as to minimize the efficiency loss associated with departing from first-best pricing. Ramsey pricing does involve price discrimination since it places a greater fiscal burden on those demanders with less-elastic demands. Some would argue that this is unfair and constitutes an inequity. Economists have no comparative advantage over others in establishing what is or is not fair. One can, however, make the following argument. Having everyone pay exactly the same price is no more fair or equitable than charging different prices. If users are charged the cost for which they are responsible, this seems quite equitable. Different cost responsibility would justify different prices. Furthermore, if those paying the higher prices are as well off or better off, measured in terms of economic welfare, as a result of allowing those paying the lower prices to participate in the market, there is also no inequity.

### *Fairness in Financing Capacity*

The issue of generating funds for capacity expansion raises the question of fairness (equity). At first glance, the generation of funds to cover the financing of capacity through average cost pricing, a common method, appears to be a fair method since each user pays an equal amount. In fact, this is an inequitable (as well as inefficient) method as it entails a subsidy to peak-period users from off-peak users. Short-run, marginal cost pricing in which peak-period prices are set higher than off-peak prices is a more equitable method of raising funds to finance capacity.

Fairness also requires that both fixed and variable costs be allocated to those users responsible for them. Some parts of infrastructure are designed for a sub-group of users, and it is unfair to spread this cost across all users except to the extent that benefits which may accrue to other users, directly on indirectly, may be considered in a Ramsey-type pricing scheme.

The question of financing capacity from users versus the general revenue fund (all taxpayers) is an issue of both efficiency and equity. If marginal cost is less than average cost, efficient pricing will result in a deficit. This deficit must be covered. A partial equilibrium approach to this problem would support a policy of funding the deficit out of general revenue while a general equilibrium approach would argue that the relative welfare losses of funding the deficit users versus the general taxpayer should be considered. As already stated, recent evidence (Jorgenson, 1992; Jorgenson and Yun, 1990; Ballard, Shoven and Whalley, 1985) has shown that the marginal cost of public funds is between $1.33 and $1.45. This means that between 33¢ and 45¢ per dollar are lost through a private-sector efficiency loss. It is, therefore, not obvious that proposing a policy of marginal social cost pricing and ignoring the costs of public funds to finance a deficit will necessarily improve economic welfare. A second-best pricing scheme in which there is a cost-recovery constraint may lead to a higher level of economic efficiency.

## 2.5 APPLICATIONS OF PRICING PRINCIPLES

Although economists have long argued for the introduction of efficient pricing of transportation infrastructure, little progress has been made by governments. This has been due in part to the view by governments (and of the general public) that infrastructure should be provided at no or a very low charge and that investment in roads and airports promotes economic development and, therefore, excess capacity provides a public good. As such, the allocative and productive efficiency with which infrastructure is provided and operated has not been of concern in most countries. Another important reason for the lack of efficient pricing schemes is the failure by the analysts to provide visible and measurable benefits of efficient pricing.

Until recently, the instances of significant capacity shortfall have occurred only at limited times of the day and at a limited number of locations. However, the recent growth in air travel and the reorganization of the aviation industry together with a failure to invest and price efficiently have led to significant shortages of both runway slots and gates. During the last two decades or so, severe congestion has also occurred on many urban and some intercity roadways. Policy makers could, therefore, rightly ask the questions: What happens if we do implement efficient road or runway pricing? Who gains? Who loses? What is the overall net benefit? These are legitimate questions, and economists have sought to provide answers in a growing applied transportation pricing literature. The outcome of the analysis can be generally divided into two areas: the effect on the use of infrastructure and the impact on investment in infrastructure.

There are few examples of governments introducing prices to achieve the efficient use of roads or runways, even in cases of severe congestion. The introduction of road pricing in Singapore (Holland and Watson, 1978) and the experiment in Hong Kong (Harrison, 1986) are two examples frequently cited. More recently, road pricing has been introduced in Norway (Larsen, 1988). Bergen, Oslo and Trondheim charge fees for vehicles entering a specified area of the city. Oslo and Trondheim use manual and electronic collection systems respectively while Bergen's is a manual system. In

Britain, peak-load pricing has been in effect since the early 1970s to ration airport terminal and runway capacity at London's Heathrow Airport. It was extended to other airports including Gatwick and Stansted in the early 1980s to encourage efficient use of the facilities. The peak and off-peak fees (the combined landing and passenger fees) at the three London area airports are illustrated in Table 2.1. It is important to note from the table that the peak-period fee at Heathrow Airport is 2.5 to 4 times the off-peak fee, depending on the type of aircraft.[11]

*Table 2.1*

LANDING FEES AT THE BRITISH AIRPORTS AUTHORITY'S (BAA PLC.) LONDON AREA AIRPORTS (ALL FIGURES ARE IN UK £, 1991)

| Airport | Peak | Off-peak | Weighted average |
|---|---|---|---|
| **Heathrow** | | | |
| B 757[a] | 1680 | 658 | 844 |
| Shorts 360 | 654 | 153 | 318 |
| B 747 | 6259 | 1747 | 3336 |
| **Gatwick** | | | |
| B 757 | 1122 | 450 | 634 |
| Shorts 360 | 444 | 111 | 211 |
| B 747 | 4866 | 1867 | 2709 |
| **Stansted** | | | |
| B 757 | 734 | 365 | 507 |
| Shorts 360 | 123 | 71 | 88 |
| B 747 | 3807 | 1806 | 2810 |

**Source: Arthur Reed, "The Unlocking of Heathrow," *Air Transport World* (September 1991), pp. 28–33.**

**[a] The Boeing 757 seats 140 passengers and is a Stage III aircraft, and thus it has a lower noise charge. The Shorts 360 seats 22 passengers. The Boeing 747 seats 270 passengers and is a Stage II aircraft which carries a higher noise charge.**

There have been numerous simulation studies using artificial data which have attempted to determine the impact of introducing infrastructure pricing. What would happen to the use of the facility by different user-groups? Would the infrastructure be self-financing? What would happen over the longer term if additional capacity were needed? What is gained (or lost) in undertaking such a policy? These studies use information on existing demand and costs in a modelling framework to address the questions just raised.

Levine (1969) was one of the first to recommend efficient pricing of airport runways. He argued that not pricing efficiently had led to shortages, the excessive peaking of traffic and hence waste of resources such as labour, fuel and time. Carlin and Park (1970), Borins (1978, 1982), Likens (1976), Morrison (1982, 1983, 1987), Gillen, Oum and Tretheway (1988), Morrison and Winston (1989), and Oum and Zhang (1990) all examined various aspects of non-optimal pricing and investments at airports. Newbery (1988), Lee (1982) and Small, Winston and Evans (1989) undertook similar studies but for roadways.[12]

The conclusions of these studies, with their different time periods and data bases, form a consensus in several areas.[13] First, the existing fee structure has led to a misallocation of traffic and hence the inefficient use of infrastructure (airport and roadway) over the day. For airports, the fee structure, based on aircraft weight, is reasonably consistent with net benefit maximization at airports with sufficient or excess capacity. It is inefficient, however, at congested facilities (Morrison, 1987). The existing fee structure benefits some groups over others. In particular, general aviation, commuter and regional (local) carriers are beneficiaries while international and trunk carriers are losers (Morrison, 1983, 1987). Similar results hold for roadways. Newbery (1988) noted that vehicles impose four costs on society: road damage costs, congestion costs, accident externalities and environmental pollution costs. The current system of licence fees and fuel taxes has, as with the case of airports, resulted in a misallocation of traffic over the day and a misallocation between types of vehicles. Rural automobiles are charged too much while urban-peak automobiles and large four-axle trucks on a rural road pay too little.

Lee (1982) provides a set of efficient user-charges on the U.S. intercity roads for a sample of vehicles.[14] These are reported in Table 2.2. Gillen, Oum and Tretheway (1988) have undertaken a similar type of analysis but for airport infrastructure (Pearson International Airport, Toronto). Their results are reported in Table 2.3. These two studies illustrate the magnitude of the current underpricing to different user-groups and the magnitudes of the changes anticipated under socially efficient pricing. Which user-classes are gaining under the present system and which are losing is also evident from these studies. Furthermore, this illustration provides an intuitive feel for the notion that the current pricing system creates inefficiencies from the choice of vehicle type and the time of travel.

Table 2.2

EFFICIENT USER-CHARGES ON THE U.S. ROADS FOR A SAMPLE OF VEHICLES

(VALUES EXPRESSED IN CENTS/VEHICLE-MILE OF TRAVEL IN 1981 U.S. DOLLARS)

| **Vehicle type** | **Location** | **Key parameter** | **Pavement repair** | **User-costs** | **Admin.** | **Excess delay** | **Air pollution** | **Noise** | **Total** | **Existing average user-fee** |
|---|---|---|---|---|---|---|---|---|---|---|
| Car (3000 lb) | rural | v/c=.05 | | | 0.3 | 0.3 | | | 0.6 | 1.3 |
| Car (3000 lb) | urban | v/c=.85 | | | 0.7 | 11.2 | 1.5 | 0.1 | 13.5 | 1.7 |
| Single unit, 3 axle truck (40,000 lb GVW) | small urban | v/c=.35<br>PCE=1.2<br>ESAL=.8 | 25.6 | 7.5 | 0.5 | 2.2 | 0.2 | 0.2 | 36.2 | 4.8 |
| Combination truck, 5 axle (72,000 lb GVW) | rural interstate | v/c=.15<br>PCE=1.2<br>ESAL=1.6 | 8.0 | 5.9 | 0.3 | 0.4 | | | 14.6 | 9.0 |
| Combination truck ,5 axle (72,000 lb GVW) | urban interstate | v/c=.35<br>PCE=1.2<br>ESAL=1.6 | 24.0 | 16.3 | 0.3 | 1.4 | 3.0 | 4.0 | 49.0 | 9.0 |
| Combination truck, 4 axle (100,000 lb GVW) | rural arterial | v/c=.05<br>PCE=3.0<br>ESAL=27.2 | 408.0 | 95.2 | 0.3 | 0.3 | | 0.2 | 504.0 | 5.0 |

**Source:** **Reproduced from Lee (1982).**

**Notes:** **v/c — volume/capacity; PCE — Passenger Car Equivalent; ESAL — Equivalent Standard Axle Load**

*Table 2.3*

### COMPARISONS BETWEEN SOCIAL MARGINAL COSTS AND 1985 LANDING FEES FOR SELECTED AIRCRAFT PEARSON INTERNATIONAL AIRPORT, TORONTO (1988 CAN $)

| | Aircraft type | | | | | |
|---|---|---|---|---|---|---|
| | **B747-200** | **DC10-40** | **B737-200** | **Dash 8** | **Business jet** | **Piston** |
| **1985 fees** | | | | | | |
| Domestic | $521 | $355 | $ 80 | $ 12 | N/A | $ 0 |
| International | $769 | $524 | $ 85 | $ 15 | N/A | $ 0 |
| **Social marginal cost** | | | | | | |
| *High months* | | | | | | |
| High-peak | $426 | $376 | $269 | $213 | $211 | $161 |
| Low-peak | $246 | $196 | $154 | $ 98 | $105 | $ 55 |
| Low *months* | | | | | | |
| High-peak | $271 | $221 | $170 | $114 | $120 | $ 70 |
| Low-peak | $226 | $176 | $142 | $ 86 | $ 93 | $ 43 |
| Off-Peak | $206 | $156 | $129 | $ 73 | $ 81 | $ 31 |

**Source: Gillen, Oum and Tretheway (1988).**

Gillen, Oum and Tretheway (1988) investigated efficient pricing at Pearson International Airport. They developed a set of socially optimal peak-period prices based on measures of variable costs with runway use, measures of congestion externalities, noise externalities and fixed costs for airfield operations. A comparison of the calculated social marginal costs and the current landing fee for selected aircraft are described below. They pointed out that the fee structure used by Transport Canada is common across all Group I airports regardless of differences in available capacity and demand variation. Furthermore, the fees are weight-based and discriminate against non-domestic flights. Both generate inefficiencies.[15]

The implementation of this pricing structure was simulated to reduce annual light-plane movements from 63,000 to 28,000 with a proportionately higher reduction in the peak periods. The social marginal cost pricing of runways (noise externalities and congestion were included) would have generated approximately $50 million instead of the actual airfield revenue of $26.6 million in fiscal 1985-86. They also developed a set of terminal user-charges which varied with the peak. These were calculated to be $2.82 and $6.49 per passenger for peak domestic and international flights respectively and $1.54 and $3.54 in the off-peak. (The current charge is $1.00 per seat for domestic flights and $2.30 per seat for international flights.) The gainers and losers are the same as those identified by Morrison.

The second area of consensus in the applied pricing literature is the financing of infrastructure. Under the status quo, there is a significant deficit for roadways and to a lesser extent for airports and airways in a number of jurisdictions. The move to socially efficient or efficient second-best pricing improves the financial condition of the infrastructure agency. If social marginal cost pricing is applied to an uncongested facility, there will be a deficit. Thus, rural roads or uncongested airports would require a second-best pricing scheme to break even or a subsidy if marginal cost pricing is applied. For uncongested airports, for example, Morrison (1982) illustrated the set of Ramsey prices which yield the maximum social benefits subject to revenue covering all costs. On the other hand, a congested facility is likely to be self-financing. Oum and Zhang (1990) provided a useful example for airports. A corresponding example for roads was provided by Small, Winston and Evans (1989).

The third area in which there is some consensus is that the benefits from introducing social marginal cost pricing are significant. Borins (1982) reported that efficiency losses due to non-optimal pricing were significant for Pearson International Airport and also for the access roads to the airport. Losses were measured in terms of economic surplus defined as the difference between what individuals are willing to pay for transportation services and the social costs of providing those services. Small, Winston and Evans (1989) showed that efficient pricing of all U.S. roads with the current investment would yield an annual net welfare gain of $5.4 billion (1988 dollars), and if efficient investment policy was coupled with efficient pricing policy, the gain would increase to $7.75 billion annually.[16] Most of the gain would come from savings in pavement costs (maintenance and capital costs) which were reduced from $20 billion to $13 billion in 1982. The sources and distribution of the efficiency gains are listed in Table 2.4.

Morrison and Winston (1989) provided similar results for all U.S. airports. The welfare gain from efficient pricing would be $3.8 billion annually. Efficient pricing in conjunction with efficient investment would raise this amount to $11 billion annually. This is relative to the status quo. The values varied with assumptions regarding the elasticity of demand and value of time. The values reported here are conservative values for both demand and time. The distribution of the benefits is reported in Table 2.5.

*Table 2.4*

ECONOMIC EFFECTS OF EFFICIENT INFRASTRUCTURE PRICING FOR THE U.S. HIGHWAYS (IN BILLIONS OF 1982 U.S. DOLLARS)

| | Efficient pricing and investment (first-best pricing) | Efficient pricing with current investment | Efficient investment with current pricing |
|---|---|---|---|
| **Investment costs** | | | |
| Maintenance savings | 9.426 | 6.441 | 8.536 |
| Capital savings | -1.276 | 0.0 | -2.236 |
| **Total savings** | **8.152** | **6.441** | **6.300** |
| Trucking firms' and shippers' gains | 0.134 | -5.586 | 0.0 |
| Gains from modal shifts | 0.040 | 0.615 | 0.0 |
| Government revenue | -0.574 | 3.884 | -5.190 |
| **Total benefits** | **7.752** | **5.354** | **1.110** |

**Source: Small, Winston and Evans (1989).**

*Table 2.5*

ANNUAL ECONOMIC EFFECTS OF EFFICIENT INFRASTRUCTURE POLICY FOR AIRPORTS (CHANGE RELATIVE TO CURRENT PRACTICE, IN BILLIONS OF 1988 U.S. DOLLARS)

| Item | Efficient pricing and runway investment | Efficient pricing with current runway investment |
|---|---|---|
| Consumer surplus change from landing and takeoff fees | 1.10 | -12.53 |
| Reduced delay to travellers | 7.91 | 3.62 |
| Carriers' operating cost savings | 2.77 | 1.23 |
| Airport revenues less costs | -0.77 | 11.50 |
| **Total welfare change** | **11.01** | **3.82** |

**Source: Winston (1991).**

The airport pricing literature makes it quite clear that the failure to introduce landing fees, which more closely reflect the real costs of usage and externalities of the facilities, has generated significant economic waste. This waste is measured in real resource costs to carriers who use crew time, fuel and capital in congested facilities.[17] It is also measured in wasted time to travellers. These delay costs can mount into the billions of dollars.

## 2.6 SUMMARY

There is a broad literature which has examined almost every aspect of infrastructure pricing from simple congestion models with homogeneous traffic to infrastructure pricing with several user-groups, uncertainty, varying demands and intermodal congestion. Despite the varied approaches and level of complexity in the models, all studies find that optimal prices for peak-period use are well above those currently charged. Calculated net benefits from measures which introduced some "demand management" were significant. This applies to all modes of transportation in the intercity passenger system despite differences between modes.

The motivation to develop socially efficient prices arises from the need to limit the use of existing facilities and to maximize economic efficiency. The latter objective is not some idol but rather is based on the argument that such pricing would make society better off by having both the efficient use of a facility and an optimal amount invested in infrastructure. Gillen, Oum and Tretheway (1988), for example, have shown that the current landing fee structure in Canada (and elsewhere), which is based on the weight of the aircraft, is inefficient in a situation where congestion exists. Indeed, they demonstrate that the largest proportion of marginal social costs is made up of movement delays to other aircraft and noise externalities. Thus, current landing fees, which ignore the congestion externality, undercharge aircraft in inverse proportion to their weight.

The air transport sector is subjected to problems not unlike those found in urban areas — peak-period demands with multiple user-groups. The road and airport runway pricing literature demonstrate that an effective solution to the problems of airport congestion is efficient pricing *and* investment policies. This is an important point. In the past, supply management was the single strategy. Some economists, as well as other transportation experts, have focussed almost entirely on demand management through pricing. This study argues that it takes a combination of the two, pricing and investment, to yield an efficient long-run outcome.

The basic message is quite clear. Continuing the supply-side approach to solving the economy's transportation problems is not only difficult in a situation of fiscal restraint, it foregoes economic gains which are available independently of whether fiscal restraint applies. Demand management is part of an efficient approach to infrastructure management and involves setting user-charges for roadway, airport or waterway infrastructure to reflect their social costs.

Such a pricing scheme has three significant impacts. First, economic welfare increases as the demand for infrastructure is rationed more efficiently in a way which reflects the costs of using the infrastructure. Second, intermodal distortion is reduced, even with a second-best Ramsey pricing. Under the current regime of infrastructure fees the distribution of traffic among modes can be expected to result in an efficiency loss. Finally, the current pricing policy results in some infrastructure being financed out of general tax revenues. This is not necessarily inefficient if the community receives benefits as a result of the infrastructure (if there are positive externalities sufficient to justify such a subsidy). The current system also ensures that the recurring infrastructure problems of the past will continue into the future.[18] For congestion-prone facilities, basing infrastructure prices on social costs would generate sufficient funds to provide an optimal facility and have the infrastructure more likely to be self-financed.

Winston (1991) summed it up best when he said:

> Surprisingly, the belief of most economists that public infrastructure spending should be substantially increased is not based on efficient pricing and investment principles. Instead, it appears to be based on either personal observations or on a suspicion that because uncongested infrastructure is a public good, society has tended to invest too little in it. Both perspectives have diverted many economists and policymakers from realizing there are surprisingly large but plausible benefits from *efficient* infrastructure pricing and investment. (p. 114)

Marginal social cost pricing is also not incompatible with fairness or equity. Congestion or peak-load pricing in conjunction with a strategy to use the revenues can generate net positive benefits for society. Marginal social cost pricing corrects distortions rather than introduces them. Some groups are made better off and others worse off but this should not justify rejection of this pricing policy. As Hau (1991) noted, it is perhaps asking too much of a pricing mechanism to solve the pricing, investment *and* income distribution problems. One way of viewing this is to use road and airport funds from efficient pricing to both invest efficiently in capacity (new roads or runways) and to use any residual to satisfy the principles of equity taxation. Thus, a transportation fund could potentially invest in public transportation, rural roads or small airports. The magnitude of the fund would depend on scale economies and indivisibilities.

Social marginal cost pricing does not necessarily yield a surplus or break even. When the total revenue from social marginal cost pricing is not enough to cover total cost, there are three options open to the infrastructure authority:

- to continue to use social marginal cost pricing with subsidization from the general tax revenue;
- to use Ramsey pricing which provides a second-best solution with a break-even financial performance; or
- to adopt two-part pricing (access/usage tariffs).

The Ramsey pricing minimizes the loss of economic efficiency caused by deviating prices from the respective marginal costs in order to achieve financial break even. In effect, it charges a higher markup to the less price-elastic product or market segment by setting the markup in inverse proportion to the price elasticity demand.

Two-part pricing consists of a flat fee for the right to access a facility (for example, vehicle licence fee to access the road system), and a usage fee (for example, charge per kilometre of road usage). Two-part pricing leads to first-best optimality if the demand for access is not price sensitive, and if usage charges are set at the marginal costs of usage and the access fee is set at a sufficiently high level to allow the firm to break even. Furthermore, under these conditions, the regulation of the access fee alone can induce the monopoly firm to charge marginal cost as the usage price. When demand is sensitive to price, the two-part tariffs are computed by applying the Ramsey rule to the access and usage demands as if they were two separate products with interrelated demands. This then becomes a form of second-best pricing.

The use of first-best pricing with subsidies from general revenues has been long advocated in the transportation literature. There is increasing evidence, however, that the efficiency costs of raising revenue through taxes may more than offset the relative efficiency costs of moving from first- to second-best pricing schemes.

## 3. CARRIER AND INFRASTRUCTURE COST STRUCTURES: A LITERATURE SUMMARY

### 3.0 INTRODUCTION

This section summarizes the theoretical and empirical literature on the cost structure of modal services (carriers) and of the provision of infrastructure. Since the infrastructure planner must establish user-charges and make capacity investment decisions to maximize the economic welfare of society, understanding the behaviour of the combined cost of a carrier's service provision and infrastructure provision is essential for the development of a set of socially optimal prices for infrastructure.[19] If short-run costs fall because of increased capacity utilization but long-run costs exhibit constant returns to scale, it is still possible to have marginal social cost pricing and fully cover costs. If, however, long-run costs are characterized by some economies, a second-best pricing approach will be required to have total revenues cover costs and minimize the efficiency loss of deviating from first-best pricing. A prerequisite to understanding the structure of the combined cost is to understand each component, that is, carrier cost structure and infrastructure cost structure.

Social benefit maximization is the objective of infrastructure pricing and investment. The relevant cost is, therefore, the full social cost a user of transportation services imposes on society as a whole. The full social cost includes not only all private resource costs such as payments to labour, capital and energy but also external costs the user imposes on others, such as congestion costs and noise and air pollution costs. The remainder of subsection 3.0 describes several cost concepts which will be used in the sections following. Subsection 3.1 summarizes the literature on several key aspects (economies of scale, economies of traffic density and economies of scope) of the carriers' cost structure for each mode. The empirical and theoretical literature on the cost structure in the provision of infrastructure services is presented in subsection 3.2. Finally, subsection 3.3 discusses the implications of the empirical results for infrastructure pricing.

### *External Costs and Internal Costs*

Internal costs, sometimes referred to as private costs, are the costs borne by the supplying agency. These are normally, but not always, financial costs incurred as a result of purchasing factor services in the market and would include labour wages, interest on capital and the price of fuel. Although external costs represent genuine resource costs, they do not directly influence decisions of transport suppliers in their provision of transport services. The external costs include general social and environmental impacts and the cost of congestion delay imposed on third parties. It also includes the effects on non-users. There is a clear distinction between internal costs that influence the optimal choice of the transportation supplier and the external costs which affect others, but do not directly influence the supplier's decisions. However, both must be considered in the socially optimal design and pricing of infrastructure. For example, in selecting the frequency and timing of flights and type of equipment use at an airport, an airline normally does not consider the noise and air pollution resulting from such decisions.

### *Short-Run Versus Long-Run Costs*

Long-run costs, using the standard economic definition, are all variable; there are no fixed costs. In the short run, the ability to vary costs in response to changing output levels and mixes differs among the various modes of transportation. Since some inputs are fixed, short-run average cost is likely to continue to fall as more output is produced until full capacity utilization is reached. Economies of traffic density are another potential source of cost economies in transportation. Unit cost per passenger-kilometre decreases as traffic volume increases over a fixed network. The fixed network means this is a short-run rather than long-run cost. Density economies are a result of using a network more efficiently. The potential for density economies depends on the configuration of the network. Carriers in some modes, such as air, have reorganized their network, in part, to realize these economies.

In the long run, additional investment is needed to increase capacity and/or other fixed inputs. The long-run average cost curve, however, is formed by the envelope of the short-run average cost curves. For some industries, the long-run average cost often decreases over a broad range of output as firm size (both output and capacity) expands. This is called "increasing returns to scale" or "economies of scale." The presence of economies at the relevant range of firm size means that the larger the size of the transportation firm, the lower the per-unit cost of output. These economies of scale may potentially take a variety of forms in transportation services and may vary significantly according to the mode of transportation involved.

### *Common and Joint Costs*

The production of transport services in most modes involves joint and common costs. A joint cost occurs when the production of one good inevitably results in the production of another good in some fixed proportion. For example, consider a rail line running only from point A to point B. The movement of a train from A to B will result in a return movement from B to A. Since the trip from A to B inevitably results in return trip costs, joint costs occur. Some of the costs are not traceable to the production of a specific trip so it is not possible to fully allocate all costs nor to identify separate marginal costs for each of the joint products. For example, it is not possible to identify a marginal cost for an i to j trip and a separate marginal cost for a j to i trip. Only the marginal cost of the round trip is identifiable.

Common costs occur when the facilities used to produce one transport service are also used to produce other transport services. For example, track or terminals used to produce freight services are also used for passenger services. The production of a unit of freight transportation does not, however, automatically lead to the production of passenger services. Thus, unlike joint costs, the use of transport facilities to produce one good does not inevitably lead to the production of some other transport service since output proportions can be varied. The question arises whether or not the presence of joint and common costs could prevent the market mechanism from generating efficient prices. A substantial literature in transport economics (Mohring, 1976; Button, 1982; Kahn, 1970) has clearly shown that conditions of joint, common or non-allocatable costs do not preclude economically efficient pricing.

## 3.1 CARRIER COSTS

There are three key indicators of the cost characteristics of a firm. They include economies of scale and economies of scope which are long-run concepts. The other is economies of density. How do they influence costs? Why are they important to this discussion of transport infrastructure pricing? These questions will be addressed in the following subsections.

### *Economies of Scale*

There has been some confusion in the literature between economies of scale and economies of density. The distinction is important since scale is a long-run concept and thus affects industry structure whereas density is a short-run concept and is more meaningful for industry behaviour such as pricing. Density economies are said to exist when a 1 percent increase in all outputs (holding network size, production technology and input prices constant) increases the firm's cost by less than 1 percent. In contrast, scale economies exist when a 1 percent increase in output[20] and size of network increases the cost by less than 1 percent, with production technology and input prices held constant.

Economies of scale refer to a long-run average cost curve which slopes down as the scale of the transport firm increases. The presence of economies of scale means that as the size of the transport firm gets larger, the average or unit cost gets smaller. Since most industries have variable returns to scale cost characteristics, whether or not a particular firm enjoys increasing, constant or decreasing returns to scale depends on the overall market size and the organization of the industry.

The presence or absence of scale economies is important for the industrial structure of the mode. The presence of significant scale economies implies that fewer larger carriers would be more efficient and this, under competitive market circumstances, would naturally evolve over time. Scale economies are important for pricing purposes since the greater the scale economies, the more average and marginal costs deviate. It would, therefore, be impossible to avoid a deficit from long-run marginal (social) cost pricing.[21]

### *Economies of Traffic Density*

Although they have a different basis than scale economies, economies of density can also contribute to the shape of the modal industry structure and affect the way a carrier organizes the delivery of its service, spatially. The magnitude of density economies also depends on the size of the market. In the air market, for example, deregulation has allowed carriers to respond to market forces and obtain the available density economies to varying degrees. Canadian carriers have been less successful than their counterparts in the United States in realizing the maximum density economies because the market is smaller in Canada.

Keeler (1974), Harris (1977), Friedlaender and Spady (1981) and Levin (1981) have all shown that there are large increasing returns to traffic density in the U.S. railroad industry. They show that allowing all factors of production to vary, including information but not route mileage, a railway producing 10 million revenue tonne-miles per mile of road, for example, will have substantially lower average costs than a railway producing only 5 million revenue tonne-miles per mile of road. Harris (1977) estimated that approximately one third of density economies were due to declining average capital costs, and two thirds due to declining fixed operating costs, such as maintenance and administration.

Gillen, Oum, and Tretheway (1985, 1990), using data from the airline industry in Canada, illustrated that unit costs would decrease for all carriers, except Air Canada, if they carried more traffic within their given network. The authors also noted that a large portion of the density economies resulted from fixed costs associated with a network — costs which are independent of level of output.

### *Economies of Scope*

Typically, the transport firm produces a large number of conceptually distinct products from a common production facility. In addition, the products of most transportation carriers are differentiated by time, space and quality. Because a number of distinct non-homogeneous outputs are being produced from a common production facility, joint and common costs occur. The presence of joint and common costs gives rise to economies of scope. There has been some confusion in the multi-product literature among the concepts of sub-additivity of the cost function, trans-ray convexity, interproduct complementarity and economies of scope. Sub-additivity is the most general concept and refers to a cost function which exhibits the characteristic that it is less costly to produce any amounts of any number of goods in one plant or firm than to subdivide the products or service in any proportion among two or more plants. Trans-ray convexity is a somewhat narrower concept. It refers to a cost function which exhibits the characteristic that for any *given set* of output vectors, the costs of producing a weighted average of the given output vectors is no greater than the weighted average of producing them on a stand-alone basis. Economies of scope refers to the cost characteristic that a single-firm, multi-product technology is less costly than a single-product, multi-firm technology. It, therefore, is addressing the issue of the cost of adding another *product* to the product line. Interproduct complementarity is a weak test of scope economies. It refers to the effect on the marginal cost of one product when the output of some other product changes. It, therefore, is changing the a*mount of output* of two or more products and not the *number of products*. Whether scope economies exist, and the extent to which they exist, depends on both the number of products and the level of each output. No reliable empirical estimates of economies of scope for transportation modes exist which are both based on reliable data and undertaken in a theoretically consistent fashion.

### 3.1.1 Air Carriers

A considerable number of studies, Douglas and Miller (1974), Keeler (1974), Caves, Christensen and Tretheway (1984), Caves, Christensen, Tretheway and Windle (1985), McShan and Windle (1989) and Gillen, Oum and Tretheway (1985, 1990), have been directed at determining the functional relationship between total per-unit operating costs and firm size in airlines. All studies have shown that returns to scale are roughly constant; thus, size does not generate lower per-unit costs. Generally, however, the measures of economies of density illustrate that unit cost would decrease for most carriers, in both Canada and the U.S., if they carried more traffic within their given network.[22] In other words, the industry experienced increasing returns to density. The results also indicated that the unexploited economies of density are larger for low-density carriers.

Caves, Christensen, and Tretheway (1984) have shown that it is important when measuring costs to include a network size variable in the cost function, along with output, which would allow for the distinction between returns to scale (RTS) and returns to density (RTD). McShan and Windle (1989) used the same data set as that used by Caves et al., and explicitly account for the hub-and-spoke configuration that has evolved in the United States since deregulation in 1978. They estimated a long-run cost function which employs all the variables included in Caves et al., and found the returns to density of about 1.35. The hubbing variable indicates that, *ceteris paribus*, a carrier with even 1 percent more of its traffic handled at hub airports expects to enjoy 0.11 percent lower cost than other similar carriers.

### 3.1.2 Intercity Buses

According to Gillen and Oum (1984), the hypothesis of constant returns to scale could be rejected for the intercity bus industry in Canada where they found decreasing returns to scale at the mean of the sample (0.91). Large firms exhibited strong decreasing returns to scale, and small- and medium-sized firms exhibited slight departures from constant returns. These empirical measures may be biased, however, since no measure of network size and market density was included in the estimation. This exclusion would have a differential impact on the measure of scale economies depending on the route mix of each firm. No cost complementarities were found to exist between the three outputs, namely, number of scheduled passengers, revenue vehicle miles of charter, tour and contract services and real revenue from freight. These results, however, are biased since no network measure was included in the estimating equations. The scale economy measure, therefore, contains some of the influence of available density economies.

Since deregulation of the intercity bus industries in the United States and the United Kingdom, the number of firms has been reduced significantly. In the absence of scale economies, the forces leading to this industry structure would include density economies. Route reorganization, for example, has been observed to approximate hub-and-spoke systems and the use of smaller feeder buses on some rural routes.

The industry reorganization is similar to what occurred in the airline industry. The consolidation of firms was driven by density and not scale economies. One significant difference between these two industries, however, is that airline demand has been growing while intercity bus demand is declining.

### 3.1.3 Trucking

Several empirical analyses of the trucking production function have shown that the long-run marginal cost and average cost curves are relatively flat with respect to changes in the level of output. In other words, economies of scale are either absent or very small. Koenker (1977) showed that there are very small economies of scale present up to relatively low levels of output and, thereafter, unit costs tend to rise gradually. Friedlaender and Spady (1981) also found mild diseconomies of scale in the production of trucking services as well as cost complementarities in the production of the multiple outputs trucking firms produce. Friedlaender and Bruce (1985) found that, for the period from 1974 to 1979, larger firms experienced greater diseconomies of scale than smaller firms. In 1979, however, the situation was reversed and, in their study, the authors suggested that the larger carriers were reaping the benefits from longer hauls.

Friedlaender and Chiang (1984) examined the effect of various network variables on trucking costs. Their study found that at the mean of the data there were constant returns to scale, while, as with other modes, there were significant gains from better network utilization, hence economies of density. Ying (1990) examined the impact of deregulation on the productivity in the United States Class I and II trucking industry. He found that at the sample mean, a 1 percent increase in output caused total cost to increase by about 1.073 percent, suggesting very slight decreasing returns to scale. It is unlikely, however, that given the size of the standard error this result is statistically significantly different from 1.00 or constant returns to scale.

### 3.1.4 Railways

The structure of railway costs is generally characterized by high fixed costs and low variable costs per unit of output. The essential production facilities in the railway industry exhibit a significant degree of indivisibility. As with other modes, the production of railway services gives rise to economies of scope over some output ranges. For example, track and terminals used to produce freight services are also used to produce passenger services.

Caves, Christensen and Tretheway (1980) found that the United States railway industry was characterized by constant returns to scale over the relevant range of outputs. However, their sample did not include relatively small railroads, firms with less than 500 miles of track. Griliches (1972) and Charney, Sidhu and Due (1977) found increasing returns to scale for such small U.S. railroads. Friedlaender and Spady (1981) suggested that there may be very small economies of scale with respect to firm size. Keeler (1974), Harris (1977), Friedlaender and Spady (1981) and Levin (1981) all found large and significant economies of traffic density in railway services. Friedlaender and Spady (1981) estimated a short-run cost function with five variable inputs, one quasi-fixed factor (structures) and two outputs which took the form of hedonic functions, accounting for factors such as low-density route miles and traffic mixes. The study found constant returns to scale but increasing returns to traffic density. Caves, Christensen, Tretheway and Windle (1985) examined economies of scale and density in the United States railroads. Their basic result demonstrates that there are substantial returns to density in the U.S. railway operations.

The economies of traffic density and economies of scale estimated by various studies are compared in Table 3.1.

*Table 3.1*

*RETURNS TO DENSITY AND SCALE IN U.S. RAILWAYS*

| Study | Density | Scale |
|---|---|---|
| Friedlaender and Spady (1981) | 1.16 | .88–1.08 |
| Caves, Christensen and Swanson (1981) | — | 1.01 |
| Harmatuck (1979) | 1.92 | 0.93 |
| Harris (1977) | 1.72 | 1.03 |
| Keeler (1974) | 1.79 | 1.01 |
| Caves et al. (1985) | 1.76 | 0.98 |

**Source: Table 4.3 in Caves, Christensen, Tretheway and Windle (1985).**

**Note: Estimates of returns to scale are for fixed length of haul and trip length.**

## 3.2 INFRASTRUCTURE COSTS

As early as 1962, Mohring and Harwitz demonstrated that the financial viability of an infrastructure facility, under optimal pricing and investment, depended largely on the characteristics of its cost function. To quote Winston (1991):

> If capacity and durability costs are jointly characterized by constant returns to scale, then the facility's revenue from marginal cost pricing will fully cover its capital and operating costs. If costs are characterized by increasing returns to scale, then marginal cost pricing will not cover costs; conversely, if costs are characterized by decreasing returns to scale, marginal cost pricing will provide excess revenue. (p. 115)

The objective of this subsection is to summarize the theoretical and empirical literature on the cost characteristics of modal infrastructure. The discussion deals with the following types of infrastructure: airports, highways and railways.

In developing a set of socially efficient prices for modes of intercity transport, it is not just the carrier's cost structure which is important. Airports, roadways and harbours all represent public capital which is used by the carriers in the different modes to produce and deliver their modal services. This capital must also be priced in an efficient way to achieve the economic welfare gains available from economically efficient pricing. As with the carriers, the ability to apply first-best pricing principles to infrastructure and still satisfy cost-recovery constraints depends on the cost characteristics of building and maintaining the infrastructure.

Cost characteristics include scale economies, scope economies, density economies and utilization economies. Scale economies refer to the size of a facility. For example, is it cheaper per unit to build three runways than it is to provide two runways? If so, there are economies of scale in the provision of runways. Scope economies encompass similar concepts as with carriers. Small, Winston and Evans (1989) referred to scope economies in highways when both volume and durability are supplied. Volume refers to the number of lanes while durability refers to the ability to carry heavier vehicles. A similar concept would apply to airports (small and large aircraft, VFR and IFR traffic) and harbours (large ships and small ships). Although rail infrastructure is currently supplied by the railways, there have been moves to separate infrastructure and carrier services. This separation would mean pricing the track and terminals separately from carrier services.

Density economies should also, in principle, be evident in the provision of infrastructure. It is, for example, possible to expand outputs and all inputs for highways while holding the size of the network fixed. There are no empirical estimates of these types of economies for any mode.

Utilization economies refer to the short-run cost function. They describe how quickly average and marginal costs fall as capacity utilization approaches capacity. Although not of direct interest, they are important to consider in any cost estimation since failure to consider capacity utilization can bias upward the measures of both long-run average and marginal costs.

### 3.2.1 Airports

Economists have typically assumed that capacity expansion is divisible. In his analysis of the optimal pricing and investment in airport runways, Morrison (1983) showed that airport capacity construction is characterized by constant returns to scale. Therefore, under perfect divisibility of capacity expansion, the revenue from tolls would be exactly equal to the capital cost of capacity investment (Mohring and Harwitz, 1962). Morrison's results, however, were based on a sample of 22 of the busiest airports in the United States and did not include any small airports. In the literature, there is no empirical evidence on the cost characteristics of capacity construction of new small airports or capacity expansion of existing small airports (for example, one runway).

### 3.2.2 Highways

In general, highways produce two outputs, traffic volume which requires capacity in terms of the number of lanes and standard axle loadings which require durability in terms of the thickness of the pavement. Before determining economies of scale in this multi-product case, the measure of economies of scale for each output, or the product-specific returns to scale, must be examined. Small, Winston, and Evans (1989) reported the existence of significant returns to scale associated with the durability output of roads and the ability to handle axle loads. This is because the pavement's ability to sustain traffic increases proportionally with its thickness. They also found evidence that there are slight increasing returns to scale in the provision of road capacity; that is, the capacity to handle traffic volume. However, they reported diseconomies of scope from the joint production of durability and capacity because, as the road is made wider to accommodate more traffic, the cost of any additional thickness rises since all the lanes must be built to the same standard of thickness. They concluded that these three factors together result in highway production having approximately constant returns to scale. In other words, the output-specific scale economies are offset by the diseconomies of scope in producing them jointly.

### 3.2.3 Railways

An important difference between rail and other modes of transportation is that most railroads provide the infrastructure themselves, and the pricing is undertaken jointly for carrier services and infrastructure. In a few cases, however, ownership and/or management of the trackage has been separated from carriers. Sweden is a good example but even in the United States there have been joint running rights on tracks. This creates a situation where one firm may be responsible for the provision of trackage and another for carrier services. It is, therefore, legitimate to ask if there are any scale economies in the provision of railway infrastructure. There are no empirical estimates but it may be possible to use some of the Small, Winston and Evans (1989) work for roads to shed some light on the issue.

Small et al. argued that road infrastructure produces two outputs, durability and capacity. The former refers to the thickness of roads and the latter to their width. They found increasing returns with respect to durability. This is less likely to occur with a rail line since there would be a relatively broad range of rail car axle loadings for a given level of durability of rail, ballast and ties. Thus, there may only be minor economies. The authors found some minor increasing returns to scale in the provision of capacity. One would expect these same economies would exist for rail since doubling track more than doubles capacity (Gillen and Oum, 1984). Small et al. found diseconomies of scope from the joint production of durability and capacity for highways. These diseconomies are less likely to be evident in rail due to the broad range of durability noted above and the ability to allocate traffic to specific tracks. On balance, there may be generally constant or minor increasing returns in the provision of rail line infrastructure. This conclusion, however, is reached from an intuitive discussion of capacity expansion costs and not from empirical estimates.

The output-specific scale economies seem to be minor as do the diseconomies of producing them jointly. In Canada since VIA Rail leases track from CNR and CPR, the relevant question is, what is the optimal price for VIA's use of tracks?

## 3.3 SUMMARY OF THE COST STRUCTURE FOR CARRIERS AND INFRASTRUCTURE

The full costs of a mode are the sum of infrastructure costs and modal services costs. Since the choice of a particular basis for infrastructure pricing will influence the modal choices of the end users, optimal pricing strategies and cost recovery should consider the combined cost of infrastructure provision and carrier (or user) costs in order to maximize social welfare. If markets for carrier services are competitive and there are constant returns in the provision of infrastructure for the mode, marginal (social) cost pricing will yield a socially efficient outcome and full cost recovery. If there are economies, from whatever source in the provision of infrastructure, first-best pricing may result in a deficit requiring a subsidy from general revenues which has consequences for economic welfare. Second-best pricing to recover costs may also lower social welfare. The issue is which minimizes the loss.

### 3.3.1 Air

A number of studies have been directed at determining the behaviour of an airline's cost function with respect to changes in the level and composition of output. The studies have shown that the long-run average cost curve is relatively constant over a wide range of output associated with different scales of plant; that is, there are no economies of scale in the airline industry. This means that the size of a carrier does not generate lower per-unit costs. Gillen, Oum and Tretheway (1985, 1990), however, found that the airline industry in Canada experienced increasing returns to traffic density; that is, the unit cost would decrease for all carriers (except Air Canada) if they carried more traffic within their given network.

Studies concluded that airport capacity construction is also characterized by constant returns to scale. This implies that the combined cost of carriers and infrastructure is also characterized by constant returns to scale.[23]

### 3.3.2 Road

There are somewhat different results for intercity bus and truck. Several empirical studies of the trucking industry found constant returns to scale in the industry while studies on the intercity bus industry found the hypothesis of constant returns to scale rejected in favour of decreasing returns to scale (0.91). The research also found no economies of scope between the three outputs, namely, scheduled passenger, charter and contract services. There is no empirical evidence on density economies. Observing the parallel mergers which have occurred in the United States and the United Kingdom bus industries after deregulation, however, one might hypothesize that there are density economies.

Road infrastructure yields two outputs, namely, traffic volume which requires capacity (measured in number of lanes) and standard axle loadings which require durability (measured in thickness of pavement). Small, Winston, and

Evans (1989) reported the existence of significant economies of scale with respect to the durability of road and mild returns to scale with respect to traffic volume. However, they reported diseconomies of scope from the production of both durability and traffic volume because, as the road is made wider to accommodate more traffic, the cost of any additional thickness rises since all the lanes must be built to the same standard of thickness. The final outcome of these three factors at work is that highway capacity construction is characterized by approximately constant returns to scale. In other words, the output-specific economies of scale are offset by the diseconomies of scope for having to produce them jointly. Since they included both infrastructure costs and the costs incurred by road users (individual drivers and transportation carriers) in the total cost of highway modes, their result on the overall constant returns to scale is for the combined cost of highways and users.

### 3.3.3 Rail

Currently, an important difference between the railway mode and other modes is that rail infrastructure is provided by carriers and thus the infrastructure cost is reflected in the freight rates and passenger fares. Since railway companies provide their own infrastructure (VIA Rail in Canada is an exception and Amtrak in the United States is a partial exception) the carrier's cost structure represents those of the combined carrier and infrastructure costs.

Several studies in the United States have shown that the railway industry is characterized by constant returns to scale over the relevant range of output. Studies have indicated, however, that economies of scale are present for small-sized firms. On the other hand, all studies have shown that there are large and significant economies of traffic density in railway services.

# 4. A FRAMEWORK FOR THE ANALYSIS OF OPTIMAL USER-CHARGES AND COST RECOVERY

## 4.1 GENERAL FRAMEWORK FOR USER-CHARGES AND COST RECOVERY

In this chapter, the general framework for integrating optimal user-charges and investment is presented and applied to airport and road infrastructure. A similar approach to that proposed by Small, Winston and Evans (1989) is taken to model the integrated pricing and investment decision. This approach has an advantage of treating the choice of price, capacity and a durability simultaneously. This model can be applied to all types of infrastructure but this study presents the analysis using roads as the example.

The social benefit from infrastructure, defined as the difference between what ultimate consumers are willing to pay and the combined cost of providing modal services and infrastructure, can be maximized by choosing price, capacity and a durability standard which maximizes the following expression:

$$\underset{Q_t, W_t, D}{\text{MAX NB}} = \sum_{t=1}^{T} \left( \int_0^{Q_t} P_t(Q)dQ - Q_t \bullet AC_t(Q_t, W,D) - M(Q_t, W, D) - rK(W,D) \right) \quad (4.1)$$

where $P_t\ (Q)$ represents the inverse travel demand function expressed in real (price) present value terms; $AC_t$ is the average cost function in year $t$ expressed in present value terms and includes all of the expenses of users including users' value of travel time; the road authority expenses are contained in $M$, the present value of the average total maintenance cost per year including the cost of resurfacing and $K$ the capital cost of road construction; $Q_t$ the traffic volume in year $t$; $W$ the width of the road; $D$ the durability standard (thickness of the pavement) for roads; and $r$ is the real interest rate. The following optimality rules for pricing, investment in capacity and durability standard can be obtained from the following first-order conditions:

$$P_t = \left( AC_t + Q_t \frac{\partial AC_t}{\partial Q_t} \right) + \frac{\partial M}{\partial Q_t} \quad (4.2a)$$

$$T\left( \frac{\partial M}{\partial W} + r\frac{\partial K}{\partial W} \right) = \sum_{t=1}^{T} Q_t \frac{\partial AC_t}{\partial W} \quad (4.2b)$$

$$T\left( r\frac{\partial K}{\partial D} \right) = \sum_{t=1}^{T} \left( Q_t \frac{\partial AC_t}{\partial D} + \frac{\partial M}{\partial D} \right) \quad (4.2c)$$

The optimal pricing rule in (4.2a) indicates that the total road charge paid by the user should be equal to the sum of private user costs plus the costs of congestion and road damage repair. This is essentially the social marginal cost of road use which varies over time. The cost paid for infrastructure would be equal to the sum of the last two terms in 4.2a, $\left(Q_t \frac{\partial AC_t}{\partial Q_t}\right) + \frac{\partial M}{\partial Q_t}$. The optimal road capacity rule in (4.2b) indicates capacity should be constructed to the level where the marginal benefits from reduced congestion delays (the right side of the equation) become equal to the increased capital cost of construction and maintenance (the left side of the equation). Finally, the optimal durability condition in (4.2c) indicates that the durability of infrastructure must be set at the level where the marginal benefit from increasing investment in durability (terms to the right of the equal sign) equals the additional capital cost.

These rules for optimal pricing, capacity and durability can be applied to any modal infrastructure including roads and airports. The optimal pricing and capacity conditions determine prices and investment levels for airports since the cost of increasing the durability of an airport runway is negligible relative to the cost of congestion delays. On the other hand, since road maintenance costs are significantly influenced by the thickness of the road, all three conditions (pricing, investment and durability) need to be determined simultaneously in the case of roads.

## 4.2 PRICING AND INVESTMENT IN A NETWORK

This subsection examines the issue of transferring funds between parts of a network (aviation, road or rail) in response to the potential sources of so-called "network externalities." It also discusses arguments that suggest the (allocative efficiency) welfare loss from failing to cross subsidize is minor compared to the (productive efficiency) welfare loss from cross subsidizing.

The essence of the question of pricing and investment rules for multiple roads or airports is whether, for pricing and investment, they should be viewed as independent or as a linked network. If the set of airports, for example, is considered as a network, there may be a price for runway and terminal use which is averaged over the network, similarly to roads. On the other hand, if each airport or roadway is considered independently the price set would consider the cost and demand conditions on that link or at that airport. Many argue that complementarities exist between links (roads) or nodes (airports) and socially efficient pricing must reflect these positive externalities. Averaging prices over the network is one practical way of reflecting such externalities in what is charged. Another method would be to transfer revenue from one facility to another after establishing socially efficient prices.

Consider a system which contains several links and nodes. This could represent a road, air or rail network. Should the setting of user-charges at i be affected by some other node such as j? For example, if j is a small airport and i is a major airport, can a cross subsidy to j from i be justified on economic grounds? Some would say yes if there is a consumption externality between i and j, or if there are decreasing costs at j and constant returns at i, economic welfare is improved by setting $P_j = MC_j$ and $P_i > MC_i$. It is not clear, however, that either network externalities or scale economies are sufficient to justify a cross subsidy.

Consider a situation in which i and j are operated with optimal productive efficiency (an assumption returned to later) or equivalently they are operating on the most efficient cost function. Set runway prices at i are equal to social marginal cost such that the sum of revenues equals costs. At j, setting price equal to marginal costs results in a deficit. What are the options? If there is some lumpiness at i, the Oum and Zhang (1990) result suggests revenues will be available to subsidize j. A second alternative is to raise fees at i to generate revenues for node j such that the surplus at i equals the deficit at j. In this circumstance the welfare loss would be borne by all routes including movements from j to i. Rather than "tax" users at i, the operator at j could employ Ramsey pricing to achieve full cost recovery at j. Suppose ij traffic is the least price elastic, this group will pay proportionately more than, say, ji passengers. The welfare loss, in this case, would be restricted to the j and i markets. In the former case the welfare loss is spread over i,j,k,n,m and e markets. Which approach has a greater welfare loss will depend on the values of the elasticities and the amount by which price changes. This, albeit, simple analysis leads to the following questions: Is there a rationale for the transfer? Why is there a deficit? Should the set of airports or links be treated as a system rather than as individual operations to be priced separately *and* independently?

First, is there a rationale for the transfer? Some argue that there is complementarity between j and i since j feeds passengers to i. While this is true, the cost savings represent a gain to the airlines providing the service through density economies and are not a gain to the airport. To the extent it is a gain to a private firm, it should be reflected in the landing fees airlines are willing to pay at j. In other words, the density economy gained by the airline would be fully internalized through higher landing fees. It makes little economic sense to transfer the rents to the airline and not have j exploit the fiscal capacity it has available. This means landing fees should be increased above marginal cost at j in a price-discriminating fashion until the deficit is covered.

Second, why is there a deficit? What about increasing returns to scale or some other form of cost economies which lead to average cost being greater than marginal cost? While this may be a legitimate source of potential gain, it will likely rest with the smaller airport since evidence suggests constant returns to scale for larger airports (Morrison, 1983). Marginal cost pricing results in a deficit at the small airport and breaking even at the large airport. But this is the argument discussed above regarding the relative values of Ramsey pricing at j or increasing all prices at i to cross subsidize j, and there is no evidence one way or the other as to which welfare loss is greater.

Economies of scale at j are not a sufficient reason to cross subsidize from i nor are they a sufficient reason to subsidize from general tax revenues. Indeed, as argued elsewhere, subsidizing from general tax revenues may also result in a net welfare loss. Thus, in the case of airports, there does not seem to be a demand side argument for cross subsidy. The choice is between Ramsey pricing at j or a subsidy from the general taxpayer, whichever has the lower welfare loss. What about roads? The same arguments would seem to hold here as well. Trucks, buses or even cars could have density economies but these should be internalized through normal commercial transactions.

Should the links and nodes be treated as a system or individually? This depends on a number of factors including the second question raised above, why is there a deficit? Other factors include the practical ability to price separately, to have the information to price efficiently, to have some idea of the welfare losses of moving from link- or node-specific prices to some "average" system price and the extent to which there is substitution between links, nodes or routes. The greater the extent of substitution the stronger the case for individualized facility pricing.

Airports have no apparent demand side externalities. They are also sufficiently distinct that it is possible to identify demand and supply at each facility and establish a set of efficient prices. Furthermore, the set of efficient prices leads to optimal investment decisions at each airport to reflect the need for capacity. If there were increasing returns at one or more airports the decision to "tax" major airports to subsidize smaller airports would have to weigh the welfare gains associated with such a subsidy at the recipient airport against the welfare losses at the taxed facilities. It also seems to imply that there is no competition between airports. To the extent there is competition, the ability to raise revenues for cross subsidy would be reduced.

Moving from a specific to a system fee is probably best illustrated by the system used in Canada until recently; fees were set to be identical for Group I airports regardless of differences in demand and costs between facilities.[24] The greater the differences, the larger the welfare loss from system average pricing. Perhaps the greatest argument for individual pricing is to provide the incentives to individual facilities to achieve least-cost production (productive efficiencies) and to exploit available "scope" economies.

There is strong and convincing evidence that system average pricing and a lack of market discipline has led to cost inefficiencies at Canadian airports (Hamilton, 1991). Furthermore, if they are explicitly or implicitly subsidized, airports have little incentive to exploit available opportunities which contribute to commercial success and break-even financial performance. Many small- to medium-size airports in the United States exploit their commercial and concession revenues to a greater extent than similar airports in Canada. They also go beyond producing the products of aircraft movements and enplaned/deplaned passengers; they exploit commercial potential and scope economies. One could argue that the welfare gains available from achieving least-cost operations far outweigh any welfare losses resulting from forcing small airports to be self-financing. Two important characteristics of airports which must be kept in mind are that they are substitutes as well as complements to other airports and they can produce many products besides those conventionally identified with airports.

Similar arguments may be made for roads, but there may be a stronger case for treating roads in a network framework. Like airports, there does not seem to be a convincing case to be made for demand side complementarities which would support an efficiency argument of cross subsidy between links. Different roads have different capacities and thus face different costs and demands. This would favour a pricing structure which reflected these characteristics. It is obvious that the distribution of traffic over the system, and the attendant welfare level, will be quite different if a single price is charged for the use of any part of the system than if the price is set equal to the marginal cost of each route and node to reflect the cost and demand conditions unique to that part of the system.

The strongest arguments for treating roads in a system are the transactions costs associated with separate pricing of each link and the lack of information regarding demand and costs on each link. It is important, however, that systems be defined to be as homogeneous as possible since, like airports, the greater the divergence in costs and demand across links the greater the welfare loss resulting from system average pricing. Prices will generally be too high on large, high-quality facilities and too low on low-density, low-quality facilities. We may thus end up with too much capacity in the latter because prices greater than marginal cost will attract capital and too little in the former since the low return will discourage capital investment. It is also important to have roadway services, produced in the most efficient way possible, achieve productive economies. This means that some links may need to be abandoned and their freed-up resources devoted to other links yielding a higher return.

## 4.3 SECOND-BEST PRICING AND SECOND-BEST INVESTMENT

The conventional first-best rule for optimizing the level of investment in transportation infrastructure is the equalization of marginal benefits and costs. If there are institutional constraints which prevent prices from being set at marginal cost in either input or output markets, the optimal investment and pricing rules must be modified. Transportation infrastructure can be financed with tolls (output taxes), fuel taxes (input taxes) or from general revenues. If there are constant returns to scale in production and divisibility in capacity investment, there is no difficulty in efficiently pricing and financing capacity. In the absence of these two conditions, however, and given the constraint that users should pay the full cost and finance the facility without a subsidy from general revenues, optimality requires a second-best investment rule in conjunction with second-best prices (input and output taxes). As Friedlaender and Mathur (1982) have shown, these investment levels and rules depend on the nature of the price distortions and financing constraints.

A second-best investment rule differs from the first-best rule. With first-best pricing and investment, prices are set equal to marginal cost. There are no output or input taxes, and investment is carried to the point at which the marginal cost savings resulting from the investment in infrastructure equals the marginal cost of the infrastructure investment. In a second-best situation the investment rule depends on the way in which the infrastructure is priced and whether there is a financing constraint. Two quite different cases can occur.

In one state, the problem may not be one of financing the facility, insuring total revenue equals total cost, but rather one in which there are output market distortions such as congestion or vehicular-generated pollution. This means that in the absence of an externality charge the mix of prices will not yield an economically efficient outcome. If there is underpricing, for example, the price set for roadway use is less than marginal social cost. A second-best pricing and investment strategy would set a fuel tax and reduce the size of the infrastructure relative to a first-best level. On the other hand if an "arbitrary" fuel tax is in place, as when governments use fuel as a source of general revenues, the second-best rule leads to setting infrastructure prices at less than marginal social cost yielding an implicit subsidy, as well as again reducing the investment in infrastructure capacity.

In this second-best situation, the reduction in the supply of capacity is used to reduce the efficiency loss resulting from the distortion in prices. This is true as long as fuel and infrastructure are substitutes (Friedlaender and Spady, 1981). If fuel prices are too high, people substitute towards infrastructure since its relative price has fallen. To offset this distortion, the supply of infrastructure is reduced to make it relatively more scarce and increase its price. Furthermore, to the extent that the elasticity of facility use with respect to the size of the facility is greater than zero, a reduction in investment brings about a reduction in demand. The same arguments hold when there is underpricing.

A second case, and one perhaps more relevant to the discussion at hand, occurs when there is a financing constraint. The long-run pricing and investment problem is to define an optimal structure of infrastructure prices and fuel taxes and determine the optimal investment in capacity. The difference in the level of investment between the first- and second-best investment rule depends on the sensitivity of revenue with respect to the amount of capacity and output taxes. Revenue will be sensitive to the level of capacity because, as capacity increases, the number of users increases and revenue from output prices will rise. If usage is highly elastic with respect to the level of capacity revenue will also be elastic with respect to infrastructure.

Friedlaender and Mathur (1982) showed that if revenue and usage are not particularly elastic with respect to investment, it is desirable to reduce investment relative to the first-best level because distortions caused by second- best user-charges, needed to finance the capacity, generate a deadweight loss burden. If revenue is elastic with respect to capacity, as it may be at some hub airports, it is desirable to expand capacity beyond the first-best level.

The second-best investment rule provides a linkage between:

- the optimal difference between the marginal benefits and costs of the infrastructure and the sensitivity of revenues to output prices and fuel taxes; and
- changes to the level of infrastructure capacity.

The simulations which have been undertaken to examine the welfare differences of first- and second-best investment rules in the presence of pricing distortions or financing constraints have consistently illustrated that the welfare loss of using first-best investment rules is relatively small. Friedlaender and Mathur (1982) undertook the simulation for rail and road and Borins (1978) performed a similar analysis for air. In both cases, the welfare surface is relatively flat primarily because the benefit function is relatively flat. Therefore, second-best pricing rules in practice can rely on first-best investment rules in establishing the optimal investment in capacity.

## 4.4 USER-CHARGES AND COST RECOVERY

Moving from the principles, outlined in Section 2 of this paper and formalized in subsection 4.1, to practice in pricing transportation infrastructure requires the development of pragmatic schemes which approximate or build upon social marginal cost pricing while simultaneously providing predictability to users and capital markets. Practical pricing schemes are discussed below, and some information of the type of changes which the various user-groups in the modes might expect with a move from current pricing principles to more economically efficient ones is provided. The illustrations are not meant to be taken as prices which would be implemented tomorrow if there is agreement to change the pricing principles. Rather they are designed to be illustrative of the magnitude and type of changes for different facilities and different user-groups with a shift to more efficient pricing.[25]

### 4.4.1 Airport User-Charges

Runways at large airports are generally built to handle the largest and heaviest aircraft currently in use by commercial air carriers. The additional construction costs for increasing the durability of a runway is small relative to the congestion delay costs.[26] Therefore, the condition of optimal durability in equation (4.2c) can be ignored in discussing airport pricing and investment.

*Major Airports*

The 1991 landing fee schedule for most Canadian airports is reported in Table 4.1. The same fee schedule is applied to all Group I and II airports and major international airports operated by Transport Canada at all times, including peak periods. The only exception is that minimum landing fees were imposed starting in 1991 at Vancouver and Toronto international airports. The use of uniform landing fees at all airports is both inequitable and inefficient because both social marginal cost and price elasticities differ significantly across Canadian airports. Other than charging higher landing fees to international flights, the current landing fees do not distinguish between short and long flights.[27]

*Table 4.1*
LANDING CHARGES
GROUP I, II AND MAJOR INTERNATIONAL AIRPORTS
CANADA

| **Domestic Flights** | | |
|---|---|---|
| Charge: $/1000 kg or fraction thereof | | |
| **Weight (kg)** | **Jet** | **Turboprop** |
| Less than 21,000 | $2.27–2.52 | $1.92–2.13 |
| 21,000–45,000 | $2.87–3.20 | $2.33–2.60 |
| More than 45,000 | $3.40–3.78 | $2.87–3.20 |
| **International Flights** | | |
| Charge: $/1000 kg or fraction thereof | | |
| **Weight (kg)** | **Jet** | **Turboprop** |
| Less than 30,000 | $2.94–3.27 | $2.39–2.66 |
| 30,000–70,000 | $3.63–4.03 | $3.15–3.51 |
| More than 70,000 | $4.01–4.58 | $4.38–4.87 |

**Source: Transport Canada (1991).**

For major airports such as Toronto, Vancouver, Calgary and Dorval Airport in Montreal, external congestion costs are a major component of the social marginal costs for runway use. Therefore, congestion tolls could become the major source to finance capacity expansion. However, the level of congestion varies substantially by the time of day. This means that peak-period pricing may be an attractive means to approximate social marginal cost pricing for runways and terminals. For example, the British Airports Authority (now privatized as BAA Plc.) has implemented peak-period pricing at all of its seven airports. At major airports such as London's Heathrow, the peak-period landing and terminal fees are about five or six times higher than the off-peak fees. The implementation of peak-period pricing in Canada could lead to a dramatic change in the structure of landing/takeoff and passenger terminal fees at major Canadian airports where congestion problems exist. Peak-period pricing would result in a dramatic increase in peak-period landing and passenger terminal fees, the elimination of the current weight-based landing fees, and the reduction of off-peak landing fees below their current levels.

Table 4.2 illustrates the primary results of a simulation of introducing peak-period pricing at Pearson International Airport (PIA), (Gillen, Oum and Tretheway, 1988). The authors examined the hourly and the daily traffic variations at PIA and found that a three-part pricing schedule made sense; one for weekday evening peak hours (1700 to 2100), one for weekday mornings (0700 to 1000) and weekend evening peak hours (1700 to 2100), and one for all other times, also referred to as off-peak hours. The charges are highest during high peaks, somewhat lower fees are levied in the lower peak, and the smallest fees are assessed in the off-peak periods. Further, an analysis revealed two distinct seasons that dominate aircraft movements: March–October, referred to as the high season and November–February, referred to as the low season. They, therefore, recommended an annual fee structure of six prices, one for each of high-peak, low-peak and off-peak periods for the two (high and low) seasons.

The authors estimated social marginal costs and compared them with the landing fees for selected aircraft in 1985 (See Table 4.2). However, under social marginal cost pricing, general aviation (GA) aircraft (represented in their analysis by light piston aircraft) which previously paid nothing for the use of runways,[28] would pay $31 for landing during off-peak periods, $161 during the summer high-peak, and $43 during the winter low-peak periods.

A heavy aircraft such as a B747-200, which used to pay $769 and $521 for a takeoff/landing of international and domestic flights, respectively, would pay $426 during summer high-peak, $246 during summer low-peak, $271 during winter high-peak, $226 during the winter low-peak and $206 during off-peak periods. The implication is that social marginal cost pricing would reduce the landing and takeoff fees for large aircraft, while substantially raising the fees for small aircraft, especially during peak periods, from their current values.

*Table 4.2*
*COMPARISONS BETWEEN SOCIAL MARGINAL COSTS AND 1985 LANDING FEES FOR SELECTED AIRCRAFT, PEARSON INTERNATIONAL AIRPORT, TORONTO*
*(1988 CAN $)*

| | Aircraft type | | | | | |
|---|---|---|---|---|---|---|
| | **B747-200** | **DC10-40** | **B737-200** | **Dash 8** | **Business jet** | **Piston** |
| **1985 fees** | | | | | | |
| Domestic | $521 | $355 | $80 | $12 | N/A | $ 0 |
| International | $769 | $524 | $85 | $15 | N/A | $ 0 |
| **Social marginal cost** | | | | | | |
| *High months* | | | | | | |
| High-peak | $426 | $376 | $269 | $213 | $211 | $161 |
| Low-peak | $246 | $196 | $154 | $ 98 | $105 | $ 55 |
| *Low months* | | | | | | |
| High-peak | $271 | $221 | $170 | $114 | $120 | $ 70 |
| Low-peak | $226 | $176 | $142 | $ 86 | $ 93 | $ 43 |
| Off-peak | $206 | $156 | $129 | $ 73 | $ 81 | $ 31 |
| Price elasticity | N/A | -0.068 | -0.075 | -0.086 | N/A | -0.58 |

**Source: Gillen, Oum and Tretheway (1988).**

The implementation of peak-period pricing based on social marginal costs by type of user is likely to shift demand for airport services to less congested airports. Piston engine aircraft which represent the bulk of the general aviation traffic could be virtually eliminated during high and low peaks in terms of the number of landings. Furthermore, Gillen, Oum and Tretheway's estimates of the price elasticities indicated that peak-period pricing would probably bring some marginal changes to air carrier scheduling. Commuter carriers would make the most changes in their scheduling to avoid the high-peak period fees; thus, the movement of heavier aircraft would increase slightly as the charges decrease.

If social marginal cost pricing had been implemented in 1986, PIA's revenue from runway operations could have doubled to reach $26.6 million. This would allow PIA's airfield operation to generate surpluses, after covering the interest and depreciation expenses. This surplus could be used to expand capacity when economically efficient to do so.

*Small Airports*

Fees at small airports can also be based on social marginal cost. However, since there is very little congestion at small airports, peak-period user-charges would not be much different from off-peak periods. Therefore, (social) marginal cost pricing would most likely lead to financial deficits since marginal cost would be less than average costs for the reasons discussed in Section 2. The two alternative modifications to efficient prices which allow substitution of a cost-recovery target were discussed in Section 2. First, the Ramsey pricing principle may be applied to achieve a cost-recovery target (including break even). Since the size of the quasi-optimal markup over marginal cost is determined on the basis of willingness to pay (that is, price elasticity), it makes sense to charge higher landing/takeoff fees to larger aircraft, which carry higher payloads than small aircraft. Perhaps this was the economic rationale for the weight-based landing fee structure currently in use in many countries, including Canada. The weight-based fee structure loses its economic rationale when congestion develops. Second, a two-part tariff (usage/access charges) can be applied to cover the system-wide or individual airport shortfall in revenue by charging access (licence) fees while charging site-specific social marginal costs as usage fees.[29]

In principle, the choice between Ramsey pricing and two-part pricing structures depends on the characteristics of demand and the proportions of fixed and variable cost in total cost. It is these elements which effect the welfare gains. Ramsey pricing would be preferred over two-part pricing structures if the elasticity of entry to the system or access to an airport is non-zero. If access is price sensitive, the variable portion of the multi-part price must be increa[illegible]ove marginal cost. In the case of multiple users, this increase would rely, essentially, on a Ramsey concept. On the other hand, usage/access fees would be preferred, from a welfare gain perspective, if the elasticity of demand with respect to access were zero, or equivalently, demand were fixed.

Theoretical second-best and "applied" second-best pricing may lead to the selection of different pricing principles, at least in the short run. An evolutionary rather than revolutionary approach may be required to minimize the complexity and to gain experience with a new system. Both users and suppliers have time to adjust. If a new pricing principle creates uncertainty, it may, in the end, result in a net welfare loss. There is a balance between moving so quickly that markets are disrupted and the potential welfare gains are lost, and moving so slowly that incumbents become entrenched, and institutions are unable to fully implement socially efficient pricing, again resulting in foregone welfare gains.

London airport, a small national airport in southwestern Ontario, is an example of the consequences of introducing new pricing schemes at small airports. The airport depends largely on the presence of the military. It is the home base of a commuter/feeder carrier. In the 1984-85 fiscal year, the airport recovered only about 20 percent of the total airfield costs from landing fees. Gillen, Oum and Tretheway (1986) illustrated the application of both social marginal cost pricing and the Ramsey price principle by type of user for this airport. Table 4.3 is taken from their study. The upper portion of the table summarizes 1985 revenues from the landing fees.

The mid-section of the table shows that application of marginal cost pricing by type of user would eliminate piston aircraft and severely reduce turboprop movements. Jet aircraft movements would also be reduced but only slightly. The marginal airfield costs estimated for this airport are $193, $110 and $78 for jet, turboprop and piston aircraft, respectively. These compare to the current average landing fees of $164, $20 and $0. Under social marginal cost pricing, the airfield revenue was expected to reach approximately $862,000 which is higher than the actual 1985 revenue. Nevertheless, it only represented about 39 percent of the 1985 airfield costs.

To achieve higher cost recovery with minimum loss of economic efficiency, a Ramsey pricing principle can be implemented. Ramsey pricing with a 62.5 percent cost-recovery target, for example, requires charging $361, $166 and $85 to jet, turboprop and piston aircraft, respectively. The results also show that implementing these charges would nearly eliminate piston aircraft movements and reduce jet and turboprop landings to 1,788 and 4,464 from the actual landings of 1,856 and 6,512, respectively. Total revenue could reach $1.4 million, about 62.5 percent of the 1985 actual airfield costs.

*Table 4.3*
*SOCIAL MARGINAL COST PRICING AND RAMSEY PRICING BY TYPE OF USER FOR LONDON (ONTARIO) AIRPORT*

| | Jet | Turboprop | Piston | Total |
|---|---|---|---|---|
| **1. 1985 situation** | | | | |
| No. of landings | 1,856<br>(7.3%) | 6,512<br>(25.7%) | 16,982<br>(67.0%) | 23,350 |
| Average landing fee estimates | $163.66 | $ 20.0 | $ 0 | — |
| Revenues | $303,760 | $130,240 | $ 0 | $434,000 |
| 1985 airfield cost | — | — | — | $2,223,000 |
| 2. Marginal cost pricing | | | | |
| Estimated MC | $192.51 | $110.29 | $ 77.94 | — |
| Price elasticity | –0.04 | –0.065 | –0.325 | — |
| No. of landings (forecast) | 1,843 | 4,601 | 0 | 6,444 |
| Revenue (forecast) | $354,778 | $507,398 | 0 | $862,176 |
| Cost recovery ratio | — | — | — | 39% |
| 3. Ramsey pricing with estimated marginal costs | | | | |
| Ramsey prices | $360.95 | $166.41 | $ 85.29 | — |
| % Markup | 87% | 50% | 9.4% | — |
| No. of landings (forecast) | 1,788 | 4,464 | 0 | 6,252 |
| Revenue (forecast) | $645,378 | $742,854 | 0 | $1,388,232 |
| Cost recovery | — | — | — | 62.5% |

**Source: Gillen, Oum and Tretheway (1986).**

Again it should be noted that costs are expected to fall as airports are defederalized. Finally, it is important to point out that marginal social cost pricing may not result in deficits at small airports if there is constant returns to scale and no significant lumpiness in capacity investment.

### 4.4.2 Summary of Pricing and Airport Cost Recovery

The major conclusions reached and changes advocated with respect to the current user-charge system may be summarized as follows:[30]

- The uniform user-charge system should be repealed in favour of site-specific user-charges.
- The current weight-based landing fees result in fees which are too low for small aircraft (primarily general aviation and corporate aircraft) and too high for large aircraft during congested periods.
- Peak-period user-charges should be implemented in airports with a congestion problem, and the differential user-charges between peak, low-peak, and off-peak periods should reflect their respective social marginal costs, including congestion externality costs. This tends to lead to a large differential between peak and off-peak fees.[31]
- A weight-based landing fee, if appropriately set, may be consistent with the Ramsey pricing principle, and thus may be economically justified at small uncongested airports. This is because the demand for airport services by larger (heavier) aircraft is less price-elastic than by smaller (lighter) aircraft. The rationale for weight-based pricing breaks down, however, when the airport becomes congested and congestion pricing is applied.
- Charging higher landing fees for long-haul international flights at uncongested airports can be economically justified because it is consistent with the spirit of Ramsey pricing; the demand for airport services by long-haul flights is more price-inelastic than short-haul flights.

## 4.5 ROAD USER-CHARGES

Previous research has led to the conclusion that the best way to economize on maintaining and using an existing road is to set user-charges equal to social marginal costs, that is, the actual cost each user imposes on society, including the effect on the road's condition, noise, pollution and the delay imposed on others. Such a charge would ensure that independent decisions by users reflect the interests of society. On the other hand, the social cost of road use largely depends on the design of the road. Road infrastructure provides capacity in the form of traffic lanes and durability in the form of pavement thickness to facilitate its use by heavy vehicles. Both road capacity and durability investments are expensive and involve scarce resources. The scarcity associated with capacity causes congestion costs while the scarcity associated with durability causes greater costs for road wear and damage (road deterioration) than for the construction of more durable roads.

Road charges should differ by type of user; for example, heavy versus light vehicles, passenger versus freight services or commercial (common carriers) versus private users. The empirical results of two previous studies on this topic are summarized to provide an indication of the direction of adjustment required in road user-charges, particularly by type of road users: a study by Nix (1989) entitled *Road-User Costs* using the most recent Canadian data, and a U.S. study undertaken by Small, Winston and Evans (1989) entitled *Road Work*.

### 4.5.1 Nix (1989)

The most significant attempt to estimate road-user costs in Canada was by Haritos (1973). He used 1968 data and employed engineering and regression approaches to allocate road costs. Nix (1989) updated Haritos' study with more recent data compiled by the Road Transport Association of Canada (RTAC) and up-to-date information on vehicle characteristics.

Haritos adopted a two-part price structure: maintenance costs (regarded as annual costs) and capital costs (fixed in the short term). The costs considered avoidable within the time frame of one year were considered escapable and, therefore, included in the (short-run) marginal cost. This measure should be used to set the user-charge per vehicle-kilometre. The costs not avoided within a year are considered inescapable, and thus treated as a fixed cost in the short run. Haritos argued that short-run fixed costs should be recovered through annual fees such as vehicle registration and licence fees.

Table 4.4 summarizes the results of Nix's cost allocation study.[32] It compares the 1986 road user-charges and the road costs by vehicle category. The results show that the annual fixed user fees (licence fees) for cars and trucks are too low to cover the short-term fixed cost of roads. In fact, the revenues from the annual fixed user-charges cover only about one third of the fixed road costs. A comparison of the user-charges and road costs imposed by user group (Table 4.4) indicates that charges for passenger cars and other light vehicles are much higher than the financial cost they impose on the road by a factor of 3 to 1 while charges are too low for trucks. In other words, light vehicles, which do not cause much damage to roads, are charged three times the cost per kilometre while heavy vehicles are undercharged. This result may not be interpreted as overcharging light vehicles because neither Nix nor Haritos considered the externality costs of noise, air pollution and congestion delay a driver imposes on others. However, it is safe to interpret the result as undercharging heavy vehicles. Nix also pointed out that, during the past two decades, road user-charges in Canada did not increase as fast as road construction costs.

*Table 4.4*
*COMPARISON OF ROAD-USER-CHARGES AND COSTS*[a]
*(1986 CAN $)*

| | User-Charges | | User-Costs | |
|---|---|---|---|---|
| | **Range** | **Mid-point** | **Range** | **Mid-point** |
| **Annual charges versus annual costs** | | | | |
| Cars | $86 | | $253–$316 | $284.5 |
| 3-axle truck (18.1 t) | $250–$675 | $462.5 | $1881–$2606 | $2243.5 |
| 3-S2 tractor (32.1 t) | $450–$1600 | $1025 | $2897–$4014 | $3455.5 |
| 3-S3 tractor (46-49 t) | $600–$2700 | $1650 | $4140–$5739 | $4939.5 |
| 8-axle B-train (62.5 t) | $1450–$4000 | $2725 | $5394–$7478 | $6436 |
| B-train, empty (18.1 t) | $1450–$4000 | $2725 | $1575–$2182 | $1878.5 |
| **Trip charges (fuel) versus trip costs, per kilometre**[b] | | | | |
| Cars | $0.012- $0.020 | $0.016 | $0.004- $0.006 | $0.005 |
| 3-axle truck | $0.051–$0.084 | $0.068 | $0.026–$0.056 | $0.041 |
| 3-S2 tractor | $0.069–$0.097 | $0.083 | $0.043–$0.090 | $0.067 |
| 3-S3 tractor | $0.071–$0.117 | $0.094 | $0.063–$0.130 | $0.097 |
| 8-axle B-train | $0.086–$0.141 | $0.114 | $0.084–$0.172 | $0.128 |
| B-train, empty | $0.051–$0.084 | $0.068 | $0.020–$0.046 | $0.033 |

**Source: Nix (1989).**

**a Annual costs include the appropriate annual vehicle charge plus an annual charge for each axle on the vehicle.**

**b Trip cost includes the appropriate vehicle cost per kilometre given the vehicle weight plus a cost per axle-kilometre for each axle.**

The Nix study represents an important conceptual contribution. Clearly, there may be some argument regarding the exact numbers since those reported are based on a particular set of assumptions. What the paper does indicate, however, is that moving to marginal social cost pricing of roads has a relatively greater impact on the structure of prices among road users than on the level of prices. Indeed, with the recent increases in fuel taxes by provincial governments, there is a real possibility that car users are paying their full social costs of road use on uncongested roads. Changing the basis of prices to social marginal costs will affect the distribution of costs between car and truck and most significantly among different types of truck. The following study reinforces this point.

### 4.5.2 Small, Winston and Evans (1989)

Small, Winston and Evans derived road user-charges under an optimal investment policy (with respect to road capacity and thickness of pavement), taking into account the combined cost to the vehicle owners and infrastructure providers. Inclusion of the cost to vehicle owners of differences in highway capacity and durability was the distinguishing feature of this study as compared to Haritos (1973) and Nix (1989). This allowed Small, Winston and Evans to take into account the effects of a lower standard of road maintenance on the cost of vehicle maintenance and fuel consumption.

The two primary considerations in pricing the use of existing roads are road wear costs and congestion delay costs. The road wear costs include road maintenance costs and the user-costs for operating vehicles, including vehicle repair, vehicle depreciation, fuel expenses and their value of time. The authors computed optimal road durability by minimizing the sum of annualized road maintenance costs, user (passengers and carriers) costs and capital costs for road construction. This procedure is equivalent to determining the optimal level of investment in road quality (thickness) through a series of cost-benefit analyses. The study found that the United States builds roads of lower quality (too little thickness) than economically optimal. This increases both the combined road infrastructure and operator costs, making the road transportation sector less cost efficient than would be the case if roads were built to optimal standards. Computations are made for rigid as well as flexible pavements.

An important conclusion of the study was that a United States road-pricing policy should be targetted to reduce weight per axle as vehicles with heavy loads per axle cause most of the road damage. They emphasized that it is the weight per axle that matters, not total vehicle weight. For example, a 50,000-pound, two-axle truck causes more road wear than a huge twin-trailer rig spreading 100,000 pounds over seven axles. Most road damage is caused by heavy vehicles with a small number of axles.

To measure the congestion costs caused by vehicle traffic, the study used the concept of passenger car equivalents (PCE) per hour. The PCE for each vehicle was determined by the amount of road space it effectively took up, including the space between vehicles required for safety, compared with that of an average car. For example, a typical truck or bus has two-to-five passenger car equivalents. As in Nix's study, the authors relied on an engineering approach to quantify the relationship between traffic volume and speed. This relationship is essential to measure the extra delay caused by adding one passenger car equivalent to the traffic stream. The authors advocated significant changes in road-pricing policy for heavy trucks, shifting from a reliance on fuel taxes and weight-graduated licence fees to one of direct mileage charges steeply graduated with respect to axle loads. They estimated that such a pricing system in conjunction with a modest increase in capital outlays on improving road thickness ("a sensible investment policy") could reduce maintenance costs by about $9.4 billion a year.

Table 4.5 presents the estimates of the effects of their policy on the maintenance costs and "tax revenue" (user-charge revenue) attributable to each truck type, as a share of the total maintenance costs. This table shows that for most truck categories current user- charge revenues fall far short of maintenance costs attributable to them. The user-charge ("tax") revenues for intercity and urban roads cover only 29 percent and 14 percent of pavement maintenance costs, respectively. In contrast, under the proposed policy, the total maintenance costs for both intercity and urban roads would be fully recovered by user-charge revenues. Furthermore, the authors showed that the proposed policy would result in a welfare gain of $8 billion a year over the current pricing and investment policy.

*Table 4.5*

## CONTRIBUTION TO ALLOCABLE MAINTENANCE COSTS BY USER-TYPE[a]

| Vehicle type | Current pricing and investment | | Optimal pricing and investment | |
|---|---|---|---|---|
| | Share of allocable maintenance costs (%) | Tax revenue contribution to allocable maintenance costs (%) | Share of allocable maintenance costs (%) | Tax revenue contribution to allocatable maintenance costs (%) |
| **Intercity** | | | | |
| SU2 | 45.19 | 9.81 | 10.07 | 19.38 |
| SU3 | 0.74 | 1.31 | 1.33 | 1.35 |
| TT4 | 0.43 | 0.11 | 0.21 | 0.21 |
| TT5 | 0.19 | 0.09 | 0.33 | 0.33 |
| CS3 | 2.11 | 0.63 | 1.70 | 1.71 |
| CS4 | 0.76 | 0.33 | 0.72 | 0.72 |
| CS5 | 43.02 | 13.51 | 60.32 | 60.38 |
| CS6 | 6.34 | 2.83 | 14.60 | 14.62 |
| DS5 | 1.18 | 0.42 | 1.68 | 1.68 |
| DS6 | 0.04 | 0.01 | 0.04 | 0.05 |
| **Total** | **100.0** | **29.05** | **100.0** | **100.43** |
| **Urban** | | | | |
| SU2 | 88.24 | 11.88 | 67.52 | 67.92 |
| SU3 | 3.10 | 1.25 | 9.61 | 9.67 |
| TT4 | 0.61 | 0.13 | 0.96 | 0.96 |
| TT5 | 0.06 | 0.01 | 0.09 | 0.09 |
| CS3 | 0.58 | 0.18 | 2.49 | 2.50 |
| CS4 | 0.25 | 0.07 | 0.61 | 0.61 |
| CS5 | 5.82 | 0.40 | 6.95 | 6.96 |
| CS6 | 0.90 | 0.13 | 10.51 | 10.52 |
| DS5 | 0.38 | 0.07 | 0.87 | 0.87 |
| DS6 | 0.06 | 0.01 | 0.39 | 0.39 |
| **Total** | **100.0** | **14.13** | **100.0** | **100.49** |

**Source:** **Small, Winston, and Evans (1989).**

**[a] Type of vehicles as follows: SU2, Single Unit 2-Axle; SU3, Single Unit 3-axle; TT4, Truck Trailer 4-axle; TT5, Truck Trailer 5-axle; CS3, Conventional Semi 3-axles; CS4, Conventional Semi 4-axle; CS5, Conventional Semi 5-axle; CS6, Conventional Semi 6-axle; DS5, Double 5-axle; DS6, Double 6-axle.**

### 4.5.3 Summary of Road Cost Recovery by User-Group

The studies conducted in Canada and the United States indicate:

- Passenger cars and other light vehicles pay a disproportionately higher share of the total road maintenance costs as compared to trucks and other heavy vehicles.
- Lack of congestion tolls as well as other externality charges in both countries indicate that the current user-charge system undercharges road users on congested roads. It may also undercharge with respect to environmental costs. This is more likely in the United States where fuel tax rates are less than half of those in Canada. With increases in fuel taxes in the last year, it may well be that car users, in Canada, are paying approximately their marginal social costs on uncongested roads.
- Both the Canadian and American studies illustrate that an economically efficient pricing scheme would affect both the average level of road prices *and* the burden across user-groups. If one interprets a fair or equitable pricing scheme as one in which the prices users are paying reflect the costs which they impose, then the efficient pricing scheme which shifts the burden can also be said to be fair.
- Total road costs (the sum of capital and maintenance costs) are sensitive to the level of investment in capacity and durability and to environmental factors. In the United States, the underinvestment in durability (that is, building sub-standard roads) has resulted in an economic loss amounting to billions of dollars annually due to the increased road maintenance costs and damage to the vehicles. The study by Nix, Boucher and Hutchinson (1992) indicated that roads in Canada are built to a higher level of durability due to the harsher climate. Road deterioration costs range between 50 percent and 80 percent of total costs. Therefore, the Small, Winston and Evans (1989) numerical results must be interpreted with some care when placed in a Canadian context.

# 5. ALTERNATIVE METHODS OF FINANCING ROAD INFRASTRUCTURE

## 5.1 INTRODUCTION

In this section alternative methods of financing road infrastructure proposed by analysts and practitioners are described and evaluated. The evaluation is based on several criteria: the effect on the efficient use of existing capacity, the effect on the efficiency of investment, the implications for equity, administrative feasibility, ease and cost of collection, the practicality of generating revenue and domain of applications (that is, national, local or project basis).

For discussion, the charges related to the road transportation sector are classified into three major groups: vehicle usage, vehicle acquisition and ownership and beneficiaries of road access.[33] The most widely applied user-charges are the motive fuel taxes and annual registration and licence fees. These, along with the general revenue of the governments are the traditional sources of road financing in most countries.[34] This subsection describes each of these categories of payments made by road users. An evaluation of each category as a road financing method is treated in subsection 5.2. And finally, several alternative sets of the charging instruments are discussed and evaluated in subsection 5.3.

## 5.2 THREE CATEGORIES OF CURRENT USER-PAYMENTS

### *Charges Related to Vehicle Usage*

Fuel taxes form a major portion of the total revenue collected from the road transportation sector. In 1989, they accounted for 77 percent of the total revenue from the road sector in Canada. The use of fuel taxes can be justified in a number of ways including road usage, energy conservation and environmental pollution. The level of fuel tax can have an effect on vehicle usage, as well as the number and type of vehicles owned. Fuel taxes provide a cost-effective and administratively feasible means of allocating variable charges. There are some who argue that they approximate road usage costs for uncongested intercity roads because the total amount of tax paid varies in direct proportion with road usage. Whether fuel taxes are a reasonable proxy for reflecting road costs depends on the type of roadway and the level of traffic.

### *Charges Related to Vehicle Acquisition and Ownership*

This category includes vehicle licence fees, registration fees, vehicle inspection fees, vehicle transfer taxes and excise taxes on the purchase of vehicles, etc. Licence fees can be substantial and are usually used in conjunction with fuel taxes. In some countries, fairly steep taxes are imposed when a car is acquired. The revenues from annual licence fees and payments related to vehicle acquisition usually contribute to those road costs which do not vary, in the short run, with road use. Other payments in this category are generally regarded as fees for the services rendered by government, and thus, are not considered as a source of financing for roads.

*Charging Beneficiaries of the Improved Road Access*

The construction costs associated with access roads, in Canada and the United States, have usually been financed from general tax revenues (of both the central and the local governments). Local improvement taxes have been used in the past. Now, as their current fiscal position deteriorates, governments are attempting more and more to charge these construction costs against beneficiaries. This approach takes various forms. In the case of new subdivisions, some governments require developers to build the roads and to recover their costs from subsequent purchasers. For major improvements to access roads into a city, some local governments levy land-value increment taxes in the district clearly benefiting from the project (special assessment district). In their recent study, Allen and Floyd (1991) concluded that the tax on special assessment districts along with toll roads were the only promising new sources for funding large-scale expansion projects.

## 5.3 EVALUATION OF THE ALTERNATIVE FINANCING TOOLS

The pros and cons of each of the charging instruments are evaluated below: motive fuel taxes, a graduated per-kilometre tax based on axle weights, congestion tolls, construction of toll roads, licence fees and taxes associated with acquiring and owning a vehicle of given type, and the methods of charging beneficiaries of the improved road access.

*Motive Fuel Taxes*

Administratively, fuel taxes are easy to collect and can be used to generate large sums of money for road infrastructure as fuel demand is relatively price-inelastic. At first glance, fuel taxes also appear to be economically efficient because the more extensively road infrastructure is used, the higher the total amount of fuel tax the user ends up paying. Fuel taxes provide a relatively efficient and practical means of pricing road use but only for cars and only for uncongested facilities. Although a high fuel tax (the case in many western European countries) may have some effect in discouraging low-value road users, there are at least two important reasons why fuel taxes are not as efficient as they appear for congested urban and near-urban roads. First, the largest component of the social cost on these facilities is the cost of the congestion externality. Fuel consumption, however, is essentially unrelated to the extent of congestion externality.

Second, as Small, Winston and Evans (1989) pointed out, usage of motive fuel taxes as a major source of road financing encourages operators to use heavy trucks with fewer axles (that is heavier loads per axle). When the load per axle increases, the amount of damage to the pavement also increases exponentially (Winston, 1991). The amount of fuel tax a trucker pays under the current system rises with a vehicle's axles since trucks with more axles require larger engines and obtain lower fuel economy. This provides truckers with an incentive to reduce the number of axles thereby increasing the load per axle. These arguments make it clear that the current fuel tax system is not an economically efficient way to finance road systems. The fuel tax is neither efficient for pricing road damages (maintenance cost), nor is it efficient for pricing congestion externality. Therefore, the mechanism for pricing road use must differ across user-types. To restrict usage fees for all users to the fuel tax may well result in a net welfare loss.

### *Graduated Per-Kilometre Tax Based on Axle Weights*

As a way to price road damages efficiently, Small (1990) argued for revamping the current U.S. system of road taxes, and adopting a "steeply graduated per-mile tax based on axle weights."[35] This pricing system for road damages makes economic sense because as load per axle increases the amount of damage to the pavement increases exponentially. Furthermore, an extensive study by the U.S. Federal Highway Administration found such a graduated tax system to be feasible administratively. It requires slightly more record keeping than the weight-distance charges being used in Iceland, Norway, Sweden and several states in the United States. Small points out that such a graduated per-mile tax, which takes into account both weight and axle configuration, has been in effect, on a systematic basis, in New Zealand for years.

Several recent studies including Nix, Boucher and Hutchinson (1992) and Nix (1989) have shown that a substantial portion of the road maintenance and resurfacing costs in Canada is attributable to "environmental factors" such as elapsed time, weather and other climatic conditions. Therefore, assuming no interaction between deterioration due to environmental factors or due to use, implementation of the steeply graduated per-kilometre tax based on axle weight alone is not going to achieve maximum efficiency. For maximum efficiency, the portion of road maintenance and resurfacing costs attributable to the environmental factors may be recovered by a lump-sum tax such as annual vehicle licence fees, which may not influence usage of roads significantly depending on the value of particular elasticities.

How the fixed or unallocatable costs are allocated between a variable charge and a fixed charge depends on the relative values of three elasticities: the elasticity of access with respect to the fixed fee, the elasticity of access with respect to the variable fee and the elasticity of usage with respect to the fixed fee. If usage and access are completely inelastic with respect to the lump-sum or access fee, this fee should be set equal to average fixed costs. If, however, the just mentioned elasticities are non-zero, economic efficiency dictates that the fixed fee be reduced and the variable fee be increased. Indeed, one may expect that a greater part of the burden of meeting the revenue requirements is placed on the variable charge rather than the fixed charge since it provides more opportunity for those with more elastic demands to avoid the higher charge by consuming less of the good yet still have the opportunity to consume some of the good. A high access fee may preclude a number of people from the market. Clearly, a balance is required since too high a usage charge may also shift users to other markets.

### *Congestion Tolls*

For nearly a century, transport economists have advocated that road authorities implement congestion tolls. The basic analytical framework for peak-period pricing (based on congestion tolls) was pioneered by Pigou (1912) and modelled formally in a short-run framework by Walters (1961). As discussed, Mohring and Harwitz (1962) recast the analysis into a long-run framework and established the relationship between optimal tolls and cost recovery. Other economists who have worked on the subject have recommended the use of peak-period pricing, as a practical means to charge for congestion or variations in demand with fixed capacity. Peak-period pricing has traditionally been advocated in those cases where there is no interaction between the users of a facility. Thus, the use of the facility by one user does not impose a cost on other users such as with congestion. For example, residential users demanding electrical power during the evening do not impose a cost on industrial users who demand it during the day. Similarly, car users of a highway in the evening do not interfere with car users during the day, because in both cases the demands are independent.

Congestion tolls are recommended when the use of a facility by one user imposes a cost on other users. For example, the use of a runway or approach path by one aircraft means that other aircraft cannot use it and must incur a cost by waiting. The demands are interdependent. In the case of congestion there is a difference between private cost and social cost whereas, with peak loads, private and social costs are the same but the issue is one of who should carry the burden of capacity costs. When peak-period pricing is used as a practical alternative, it is being used to proxy the difference between private and social costs.

The chief advantage of using congestion tolls to finance the road system lies with the improved economic efficiency it achieves as it results in users paying the social marginal costs of their transportation choices. This would not only lead to the efficient use of the given capacity in the short run but also act to provide a signal for efficient capacity investment programs in the long run. Despite these advantages, except for the electronic road pricing experiment in Hong Kong (see Hau, 1990),[36] no government uses congestion tolls as a major source of financing for road infrastructure.

In the past, several problems were cited as barriers to the popular acceptance of congestion tolls. First, it is not a straightforward case of calculating socially optimal congestion tolls by road sections and by time of day or day of week. Since congestion consumes enormous amounts of a valuable resource (people's time), a reasonable approximation, which can be done quite easily, is likely to be better than completely dismissing this sound pricing method. The second barrier is that it used to take time (at least to slow down) to collect tolls. This problem is now largely solved since electronic vehicle identification (EVI) technology has become quite reliable, as proven through the Hong Kong experiment. Heggie (1991) indicates that the advent of electronic toll collection can reduce the costs of toll collection on inter-urban toll roads and bridges to under 5 percent of gross revenues. Given the rapidly advancing technology in electronic vehicle identification, toll billing and collection, congestion tolls are likely to become an important new source for road financing.

The third barrier is the alleged unfair distribution of benefits. Opponents of congestion tolls indicate that poor working people and downtown business interests have the most to lose under a congestion charging system. Careful use of the congestion toll revenues may compensate those who are expected to lose under the system. For example, Small (1990) argued that, in the case of major urban areas such as San Francisco, Los Angeles or Toronto, revenues from congestion tolls would be so large that there would be little doubt that it is possible to fully offset the effects of peak user-charges on nearly all groups, including poor working people and downtown business interests. It is also possible to eliminate the need for fuel taxes, registration fees and a large portion of the local property tax and sales tax funds now being used for road maintenance.

In sum, the system of congestion tolls can play an important role as a source of road financing in the future. Even if all of the above problems are solved, the function of congestion tolls as a source of road financing is still limited to some portions of major intercity highways (those which are near-urban), bridges and major urban roads. It would not play a role in low-density roads including rural roads.

### *Construction of Toll Roads*

In an era of fiscal conservatism, reflected by a shift from public- to private-sector provision of services, increasing constraints on governments' abilities to control resources and a general shift to a greater emphasis on efficiency, construction of toll roads is likely to become an important means of dealing with the increasing need for investment in new road systems. Currently, the toll-road networks are growing rapidly with over 5,400 kilometres in France, in excess of 5,100 kilometres in Italy, 4,700 kilometres in Japan and over 7,100 kilometres in the United States (Heggie, 1991). This can be an increasingly important source of financing for new road projects. Numerous states, including California, Colorado, Virginia and Texas, are making use of or are planning to make use of tolls as an alternative funding source (see Allen and Floyd, 1991). The British Columbia government built the Coquihalla toll highway linking Hope and Kamloops and the Okanagan Valley. Many of these toll roads charge differential tolls between peak and off-peak periods and, therefore, their pricing policy is consistent with the spirit of congestion tolls. An appropriately managed and regulated (including the monopoly nature of toll setting) toll road system can promote efficiency in using a given road capacity in the short run, and the attendant market forces will pressure the road authority into putting optimal capacity in place in the long run. Advances in collection technology are expected to encourage the use of toll facilities for building major intercity highways and urban access roads.

### *Annual Licence Fees and Taxes Involving the Acquisition of Vehicles*

Empirical studies which have investigated the impact of higher licensing fees on peak-hour car driving (raising the fixed cost of car driving relative to common-carrier services) have concluded that such fees have failed to produce any substantial improvement in congestion (Allen and Floyd, 1991). They argue that governments are going to have to substantially raise licensing and registration fees in order to have any impact on reducing car use. A substantial increase in both the one-time registration fee (at the time a new or used vehicle is acquired)[37] and annual licence fees from the current level may improve the economic efficiency of using the existing road capacity subject to the condition discussed earlier regarding the elasticity values. If there are substantial fixed road costs which do not vary with traffic volume and the road authority decides to recover these fixed costs from road users (rather than subsidizing them from general tax revenues), it will be more efficient to recover the fixed costs as lump sum annual fees (licence fees) rather than allocating them by marking up the usage-related charges (per-kilometre charge) above the respective marginal costs if the access elasticity is equal to zero. If this is not so, the conditions set out earlier will hold. Specifically, access fees will be reduced and variable charges increased until the net change in welfare with a shift between the two fees is equal to zero; in essence welfare is enhanced by exploiting available gains from trade between the two sources of funds.

Although they are likely to be unpopular, like fuel taxes, these fees are administratively easy to assess and collect. The optimal taxes and charges involving annual ownership and acquisition of vehicles can generate large amounts of revenue for the road sector as these items currently account for 42% of the total charges paid by road users in Japan, 36% in the United Kingdom and 38% in the United States (Heggie, 1991) while accounting for 23% in Canada.

### *Charging Beneficiaries of the Improved Road Access*

For developing local access roads in a suburban area, it is reasonable to require developers to build the roads and to incorporate the costs into the final selling price of the building or service site. This is an economically efficient solution in terms of both the size of the road investment as the developer is expected to make a trade-off between ease of road access and the value of the remaining lands they can sell.

For major improvements in urban road systems, a part of the construction costs may be assessed against the properly identified land-value increments. The concept of special assessment district (under which the geographic areas are identified to levy special assessments), which are being used in several states, is a feasible way to generate funds for large-scale highway reconstruction projects in a reasonably equitable way. This requires close coordination between the government with the taxing authority and the government in charge of road construction. The identification of a special assessment district and actual assessment of special levies can be a controversial process. For example, as soon as the major improvement in the road system is made, the option value of using the road can be realized by the businesses and residents in that area, and, thus, the special levies are economically justified. However, this one-time special levy does not guarantee the efficient use of the road infrastructure, and a combination of one-time special assessment for the construction costs and charging tolls (variable fees) related to road usage would yield a more efficient use of the road and a more efficient level of investment. It may be an interesting option to explore.

## 5.4 SUMMARY OF ALTERNATIVE ROAD FINANCING METHODS

Several promising sources of road financing are summarized below. Each charging method is evaluated with respect to the promotion of the efficient use of road capacity and durability, the efficiency of (capacity) investment, the potential size of the fund that could be generated, administrative feasibility and collection costs, equity among various groups and the domain of applicability. Several alternative combinations of charging methods are also evaluated and compared.

### 5.4.1 Summary Evaluation of Financing Methods

*Motive Fuel Tax*

The evaluation is restricted to its application to car users only. It would be ranked "moderate" in promoting efficient road usage on uncongested roads because the amount of fuel tax one pays is weakly correlated with road damage costs which are the responsibility of the user. It would rank "poor" in promoting the efficient allocation of peak-load capacity since its price is not correlated with road use. It would be regarded as "poor" in promoting investment efficiency on congested roads as the fuel tax does not exert much pressure to build roads with optimal design standards (thickness and capacity). Administrative ease is a strength as large amounts of funds can be collected easily with relatively small administrative and collection costs. Motive fuel tax can be applied for financing nation-wide and/or state-wide road systems. They are regarded as an equitable method of financing uncongested facilities because every user pays according to the user's consumption of fuel. It would be inequitable on a congested facility since it is not highly correlated with congestion costs.

### *Graduated Per-Mile Tax Based on Axle Weight*

It promotes "reasonably high" efficiency in both pricing road damage and inducing an optimal investment in road durability as this tax can be designed to closely reflect the road damage costs each user imposes, and this will generate enough pressure for the road authority to build roads with optimal thickness. However, if a substantial portion of road damage is due to "environmental factors," this tax is likely to achieve maximum efficiency only if it is combined with a lump-sum tax such as vehicle licence fees. This tax is not intended to be a congestion charge or a charge which would optimally allocate scarce road capacity among competing users. It can generate a large amount of funds if it replaces the current fuel taxes, but it will require some administrative work and collection expense. It is feasible to administer such a tax system. Since users pay costs they impose, it can be considered equitable. To be effective, this system should be applied in all parts of a given jurisdiction such as a province or nationally rather than trying to apply it in only a part of a province, for example. If it is applied consistently on all roads within a jurisdiction, it will induce the efficient use of the road system by trucks as well as the efficient choice of trucking technology given the roadway system. If the tax is applied piecemeal, there will be less incentive for the adoption of trucks which minimize road damage. Higher overall road costs may also result if trucks attempt to avoid the charge on some roads by using non-toll roads and generating even more pavement damage.

### *Congestion Tolls*

Tolls promote high efficiency both in the allocation of scarce road capacity and in inducing the optimal investment in road capacity (number of lanes). Congestion tolls are not intended to be a price for road damage but rather to ensure the roads are used and invested in efficiently. Congestion tolls in major urban or near-urban areas could raise a large amount of money. The Hong Kong experiment has provided convincing evidence that such a system is feasible but the cost of electronic vehicle identification and collection is expected to be substantial. Some claim that charging congestion tolls is not equitable because "poor working people" pay high congestion tolls and downtown businesses lose out. It is possible to compensate these losers by subsidizing urban transit services from the congestion toll revenues. Once the way in which the toll revenue is spent is taken into account, the actual and perceived inequity of congestion tolls may disappear. The introduction of congestion tolls or peak-load charges should not be undertaken in isolation with the expectation they will provide the solution to the pricing and investment problems. Pricing is one tool of the transportation planner and policy maker. To be effective, it must be used in conjunction with other strategies, such as substitute mode investment. To gain public support for pricing, it is essential that it not be perceived as simply another way of raising revenue for government nor that it is exploiting a situation in which people have no alternatives. For these reasons it is important that alternatives be available for those facing higher fees.

### *Toll Roads*

If they implement peak-period pricing, toll roads have essentially the same characteristics as implementing congestion tolls on the existing roads. Constructing toll roads allows private-sector participation for large project financing. As collection technology improves, toll collection costs become quite moderate. New toll roads benefit not only those who switch to the toll roads but also those who continue to use the old non-toll roads (due to reduced travel time). This is a Pareto improvement. Construction of toll roads can be considered an equitable method since lower-income users gain by travelling on non-toll facilities. In reality, toll roads can solve financing problems for specific projects only.

### *Annual Licence Fees*

These fees can be used to contribute to road costs which do not vary with traffic volume in the short run. If they are not coupled with a variable charge, as with a two-part tariff, which reflects social costs, annual licence fees will have no direct effect on the efficiency of road investment. As shown in many countries, it can generate large sums of money with relatively low administrative and collection costs. Since some people cannot afford to keep a car when annual licence fees are raised substantially, a high licence fee policy may not be regarded as equitable. One method used in some

U.S. states is to base the fee on the purchase price of the car and have the fee decline each successive year to some floor level where the floor would be the same for everyone. A system of licence fees can be implemented by national, provincial or municipal governments.

*Charging Beneficiaries*

This one-time charge to beneficiaries (developers, property owners and businesses in a special assessment district) is likely to promote an efficient level of road capacity investment, but has no effect on the efficiency of road usage (use of road capacity or durability) after construction. This is a good source of funds for a well-defined road project but it is difficult to determine the boundaries of a special assessment district, as well as the amount of special levies. Charging beneficiaries is by definition equitable. This method of financing works only on a project basis.

### 5.4.2 Evaluation of Alternative Sets of Financing Instruments

Government must temper principle with practicality and use a mix of two or more charging methods to improve economic efficiency in the road transportation sector while simultaneously attaining a cost-recovery target. Furthermore, perceived equity cannot be ignored in the selection of the menu of instruments. The following alternative sets of financing instruments are evaluated and compared:

- fuel taxes and licence fees (status quo);
- fuel taxes, licence fees and congestion tolls;
- graduated per-kilometre taxes, congestion tolls and licence fees; and
- social marginal cost pricing (graduated per-kilometre taxes based on axle weights, congestion tolls and other externality taxes).

*Fuel Taxes and Licence Fees*

Canada, as well as most other countries, currently use fuel taxes and licence fees as the major source of funds for financing road infrastructure. These two instruments together can generate total revenue which is sufficient to finance all of the road infrastructure. They are also administratively easy to collect. Licence fees, if appropriately set, can be used to recover some or all of the short-term fixed cost including the portion of road repair and repayment costs which are unrelated to road usage.

Fuel taxes do not give road users, most importantly heavy trucks and buses, the incentive to choose the optimal axle load which minimizes the combined user and infrastructure costs. This happens because commercial carriers try to reduce fuel consumption which tends to increase with the number of axles, while damage to the pavement increases exponentially with average weight per axle. A second flaw in the use of fuel taxes for pricing urban and near-urban roads is the low correlation between congestion costs and fuel use, hence fuel tax paid. The fuel tax is, therefore, a poor proxy for a congestion tax and would lack any capability for allocating peak-load capacity. Overall, the combination of fuel taxes and licence fees is not an economically efficient method of charging and financing roads.

*Fuel Taxes, Licence Fees and Congestion Tolls (Urban and Near-Urban Roads)*

The congestion toll component of this package is likely to improve the efficiency of allocating peak-period capacity, and also generate pressure to invest optimally in capacity. However, this package lacks incentives for commercial operators to use optimal axle-load weight.

*Graduated Per-Kilometre Taxes, Congestion Tolls and Licence Fees*

This combination of fees may be regarded as a transition package en route to a more socially efficient pricing scheme. This study has already addressed the value of fuel taxes and licence fees as providing a practical and effective means of pricing and financing capacity investment for intercity roads on which there is little or no congestion. The weak link is the failure to adequately price truck damage and provide incentives for operators to employ economically efficient axle loads. The fuel tax should therefore be restricted to cars and the scheme supplemented by a charge for trucks.

A graduated per-kilometre axle fee should supplement or replace current truck licence fees and fuel taxes levied on truck use. This will not only efficiently and adequately allocate cost responsibility between cars, trucks and buses but also among the various types of trucks.

Licence fees which are levied will reflect, not necessarily on a one-to-one basis, the magnitude of fixed costs. Licence fees must be allocated both between and within user groups. This means that for fairness and efficiency, trucks, cars and buses should bear a portion of the fixed costs of the roadway system — how much will depend on cost responsibility, the elasticity of access with respect to licence fees and the elasticity of usage with respect to licence fee. User-group allocation would be based on some Ramsey-type approach; for example, car users may have a licence fee based on the purchase price of the vehicle — an approach used in some U.S. states. This study does not advocate the position that the contribution by trucks and buses must be contained in a licence fee. Indeed, it may well be that the graduated per-kilometre usage fee will be the only fee levied and contain both usage and fixed contributions.

For urban and near-urban roads this pricing approach will prove to be neither equitable nor efficient. Some method of congestion pricing must be introduced to efficiently allocate existing capacity and provide for efficient investment in future capacity. Fairness, however, will be determined by the expenditure of the congestion tax revenue and taking a comprehensive approach. That is, it serves no one to focus entirely on one instrument and rely on it to provide a solution. A comprehensive approach is necessary, in which substitutes are provided for those faced with a congestion or peak-load fee. These substitutes can range from flexibility of work hours to providing public transit (of some form).

### *Social Marginal Cost Pricing*

The graduated per-kilometre taxes based on axle weights reflect the cost of road damage users inflict, while congestion tolls and other externality (noise and air pollution) taxes reflect the costs users impose on the community. Together they constitute the social marginal cost of using the road system, and charging the social marginal costs maximizes social welfare. Although the results of Small, Winston and Evans (1989) suggest that this charging scheme would result in an approximate financial break even, based on the assumption of constant returns to scale in joint production of road capacity and durability, other evidence such as Nix (1989), Nix, Boucher and Hutchinson (1992), Kraus (1982) and Oum and Zhang (1990) suggests that break-even performance is not guaranteed. In Canada where the majority of the non-urban roads are of low density (and capacity) and the indivisibility of capacity construction plays some role, the application of social marginal cost pricing is likely to produce a financial deficit in many instances.

As we have also discussed, there are also some practical and administrative difficulties in implementing the graduated per-kilometre charges based on axle weight, and the externality taxes (congestion tolls, noise and air pollution tax). Certainly, it will result in higher costs for administration and collection than the current fuel tax and licence fee combination. However, this is the correct direction in which to move for maximizing economic welfare from the road sector. As the technology of automatic vehicle identification develops and the cost of information processing decreases, the administration and collection is likely to become less burdensome than now.

# 6. SUMMARY AND CONCLUSIONS

## 6.1 PURPOSE AND ORGANIZATION OF THE STUDY

Transportation policy has undergone significant changes over the last 50 years. Canada has moved from a situation of government ownership, management and regulation in all or parts of every mode to a position of deregulation, privatization and a generally greater reliance on market forces. The major transformation has taken place among the carriers while more recent initiatives have been focussing on infrastructure — roads, airports, rail track and terminals.

Much of the stimulus for change has been the result of Canada's need to rethink traditional policies and reposition itself to remain competitive in the North American and world marketplaces. Pricing and investment planning of Canada's transportation infrastructure cannot ignore the forces and pressures developing in the United States and other international markets. Links must be established between investment in infrastructure and the pricing of services delivered by that infrastructure. Indeed, socially optimal modal pricing requires the inclusion of modal air and noise pollution and congestion externalities. Economic welfare will be lower if these factors are not considered in modal prices because demands for massive public investments in infrastructure will continue unabated, infrastructure will deteriorate prematurely, and the distribution of traffic across modes will not reflect the real costs of these modes. Solutions do not necessarily lie with more investment but rather with smarter investment. Smarter investment must start with efficient pricing.

In May 1992, the Congressional Budget Office of the United States released a study, *Paying for Highways, Airways and Waterways: How Can Users be Charged?* The study is in complete congruity with the conclusions stated here. They state in their summary:

> The methods of financing highways, airways, and waterways influence both the amount of revenue that can be raised and the efficient allocation of resources. The concept of revenue adequacy — whether revenues cover costs — is important to the cash-strapped federal government, but it also has implications for efficient allocation of resources in the long run. If the costs of an investment project cannot be recovered from those who use it, the project's feasibility comes into question. But an investment that benefits society is worth making, even though it may not be possible to charge users for it. This often characterizes goods and services provided by the federal government, and it underlies the rationale for government rather than private activity in certain sectors. Revenue adequacy can provide information about the demand by users for public investments, but it alone cannot be the criterion upon which investment decisions are made.
>
> Economic efficiency is the second criterion by which financing mechanisms are evaluated. The standard definition of allocative efficiency is used here: does the price — the value consumers place on the product or service at the margin — equal the marginal cost — that is, the value of resources used in producing the last unit? If the price is less than the marginal cost, consumers tend to overuse the resource; if the price exceeds the marginal cost, they use it too little.
>
> The objectives of revenue adequacy and economic efficiency sometimes conflict. Economic theory offers some ways of minimizing the tradeoffs, and these are included in the discussions of alternative pricing mechanisms. (p. xi)

The main purpose of this study is to discuss the principles and methods by which Canada can ensure the optimal use and efficient provision of transportation infrastructure services. Also, to reflect the move to greater fiscal responsibility reflected in a shift from public- to private-sector provision of services, increasing constraints on government's ability to control resources and a general shift to a greater emphasis on efficiency, an emphasis is placed on the cost-recovery issue. The issue is treated in two alternative ways. First, the cost-recovery conditions associated with optimal pricing and investment in infrastructure are studied and compared with the actual cost-recovery situation. Second, the methods of achieving an exogenously given cost-recovery target in such a way as to minimize the efficiency loss are discussed. Although the principles and methods discussed in the study can be applied to all modes of transportation, the emphasis is on roads and airport infrastructure.

## 6.2 INFRASTRUCTURE PRICING PRINCIPLES

Pricing is a method of allocating resources. There is no such thing as the right price irrespective of issues and objectives. Rather there are optimal prices or pricing strategies given particular objectives to be achieved. Prices can be established to maximize profit, welfare or revenues. They can be used to achieve a particular market share or a desired distribution of demand across products (for example, mode-split in transportation). However, one of the most important goals for pricing goods and services from society's viewpoint is in maximizing economic welfare by optimally allocating scarce resources and goods and services across competing needs in the short run and ensuring optimal investment in capacity in the long run.

It is well known that economic welfare is maximized by pricing infrastructure at marginal social cost which means the externality costs users impose on the system are included. Critics of the current pricing approach agree that governments have been misdirected in their infrastructure policy chiefly in trying to respond to traffic growth by expanding capacity rather than also using demand management through an efficient pricing system. Empirical studies indicate that the net social benefit from effective demand management policy is quite high. The major source of the available efficiency gains for both near-urban roads and airports is the reduction in congestion delays with a consequent savings in operating and time costs. For intercity facilities, efficient pricing leads to a more efficient use of facilities within and across modes.

Efficient user-charges which reflect social costs have three significant impacts. First, economic welfare is increased as the demand for infrastructure is rationed more efficiently in a way which reflects the costs of using the infrastructure. Second, the distortion in traffic allocation across modes is reduced. Third, it contributes to the financing of infrastructure. Furthermore, marginal social cost pricing is not incompatible with fairness or equity. The surplus from congestion tolls may be used to offset losses by some groups who may be adversely affected by increased user-fees. The British Airports Authority (BAA Plc.), for example, has used marginal cost pricing principles to establish runway and terminal charges for the five airports under its control but has redistributed revenues from one airport to another particularly for investment purposes.

Peak-load pricing is an important variant of marginal social cost pricing which formally considers the fact that some users demand and require more capacity than others. This is seen everyday on roadways, runways and in terminals. There is a clear and sound economic efficiency basis for peak-load pricing. Charging higher prices to peak users enhances economic efficiency by inducing them to make rational choice decisions as well as helping to solve financing problems for capacity expansion. Finally, peak pricing is not, in principle, unfair or inequitable. It assigns costs to those who are responsible for them. It makes no economic sense to restrict the use of a facility in off-peak hours because all that results in is the underutilization of an existing facility. In competitive circumstances or under regulation, peak users are not necessarily worse off in terms of what they pay, if there is a lower off-peak price, provided the off-peak users pay at least their variable costs. If off-peak users were eliminated from the market, peak users would pay precisely the same amount as when off-peak users pay their variable costs. The only circumstance when peak users would be better off is if they are cross subsidized from off-peak users. This creates a social loss in terms of both inefficient use of facilities and the loss of consumer surplus.

When the total revenue from the social marginal cost pricing is not sufficient to cover total cost, there are three options open to the infrastructure authority:

- continue to use social marginal cost pricing with subsidization from the general tax revenue;
- use Ramsey pricing which provides a second-best solution with a break-even financial performance; or
- adopt a two-part pricing (access/usage tariffs) scheme.

The question of financing capacity from users versus the general revenue fund (all taxpayers) is an issue of both efficiency and equity. If marginal cost is less than average cost, efficient pricing will result in a deficit. This deficit must be covered. A partial equilibrium approach to this problem would support a policy of funding the deficit out of general revenue while a general equilibrium approach would argue that the relative welfare losses of funding the deficit by users versus the general taxpayer should be considered. Recent evidence, Jorgenson (1992), Jorgenson and Yun (1990) and Ballard, Shoven and Whalley (1985), has shown that the marginal cost of public funds is between $1.33 and $1.45, meaning that between 33¢ and 45¢ per dollar are lost through a private-sector efficiency loss. It is, therefore, not obvious that proposing a policy of marginal social cost pricing and ignoring the costs of public funds to finance the deficit would necessarily improve economic welfare. A second-best pricing scheme in which there is a cost recovery constraint may lead to a higher level of economic efficiency.

Ramsey pricing minimizes the loss of economic efficiency caused by deviating prices from the respective marginal costs in order to achieve financial break even. In effect, it charges higher markup to less price-elastic products or market segments by making the markup inversely proportional to the price elasticity of the demand.

Two-part pricing consists of a flat fee for the right to access a facility (for example, vehicle licence fee to access the road system), and a usage fee (for example, charge per kilometre of road usage). Two-part pricing can lead to a first-best solution if the demand for access is not price sensitive, and if usage charges are set at the marginal costs of usage and the access fee is set at a sufficiently high level to allow the firm to break even. Under these conditions, the regulation of the access fee alone can induce a monopoly firm to charge marginal cost as the usage price. When access demand is sensitive to price, the optimal two-part tariff can be computed by applying the Ramsey pricing rule to the access and the usage demands as if they are two separate products with interrelated demands. This then becomes a second-best pricing approach.

The economics literature is paying increasing attention to the consequences of selective pricing methods for various groups of users and non-users; that is, the income distributional consequences of a pricing method. Problems arise when a pricing method which maximizes economic efficiency does not necessarily yield what is considered a fair or equitable outcome. The most obvious case where concern over income distribution appears critical is the implementation of congestion (or peak-load) pricing for (urban) transportation. The results of a number of empirical and simulation studies vary somewhat, but the basic conclusion is that it is misleading to characterize a congestion or peak-load pricing policy as being regressive.

Marginal social cost pricing is also not incompatible with fairness or equity. Congestion or peak-load pricing in conjunction with a strategy to use the revenues can generate net positive benefits for society. Marginal social cost pricing corrects distortions rather than introduces them. Some groups, however, are made better off and others worse off but this should not justify rejection of this pricing policy. As Hau (1991) notes, it is perhaps asking too much of a pricing mechanism to solve the pricing, investment and income distribution problem. One perspective is to use road and airport funds from efficient pricing to both invest efficiently in capacity (new roads or runways) and to satisfy concerns regarding equity. This study recognizes that while income redistribution issues are better placed in general tax policy, some of the concerns with the perceived inequity of efficient pricing may be allayed if some of the funds from efficient pricing are used to provide substitutes for those most affected by the use of socially efficient pricing. Thus, a transportation fund could potentially invest in public transportation, rural roads or small airports. The magnitude of the fund would depend on scale economies and indivisibilities.

## 6.3 CARRIER AND INFRASTRUCTURE COSTS

The infrastructure planner must establish user-charges and make capacity investment decisions to maximize the economic welfare of society. Understanding the behaviour of the combined cost of a carrier's service provision and infrastructure provision is essential for the development of a set of socially optimal prices for infrastructure. If short-run costs fall because of increased capacity utilization but long-run costs exhibit constant returns to scale, it is still possible to have marginal social cost pricing and fully cover costs. If, however, long-run costs are characterized by some economies, a second-best pricing approach will be required to have total revenues cover costs and minimize the efficiency loss of deviating from first-best pricing. A prerequisite to understanding the structure of the combined cost is to understand each component, that is, carrier cost structure and infrastructure cost structure.

A number of studies have been directed at determining the behaviour of an airline's cost function with respect to changes in the level and composition of output. The studies have shown that the long-run average cost curve is relatively constant over a wide range of output, that is, there are no economies of scale in the airline industry. This means that the size of a carrier does not generate lower per-unit costs. Studies also concluded that airport capacity construction is as well characterized by constant returns to scale. This implies that the combined cost of carriers and infrastructure is also characterized by constant returns to scale.

Empirical investigations of the truck and intercity bus industries have provided mixed results. The overwhelming evidence is that there are constant returns to scale in trucking, some scope economies and certainly density economies. The limited investigations of the bus industry found weak evidence of non-constant returns. There is no direct evidence of density economies but observing the restructuring of the bus industry in those countries in which there has been deregulation certainly suggests some density economies. Evidence from Small, Winston and Evans (1989) showed constant returns to scale in highway capacity construction. They reported the existence of significant economies of scale with respect to the durability of road and mild returns to scale with respect to traffic volume. They also reported diseconomies of scope from the production of both durability and traffic volume because, as the road is made wider to accommodate more traffic, the cost of any additional thickness rises, since all the lanes must be built to the same standard of thickness.

The final outcome of these three factors at work is that highway capacity construction is characterized by approximately constant returns to scale. In other words, the output-specific economies of scale are offset by the diseconomies of scope for having to produce them jointly. Since they included both infrastructure costs and the costs incurred by road users (individual drivers and transportation carriers) in the total cost of highway modes, their result on the overall constant returns to scale is for the combined cost of highways and users.

## 6.4 IMPLEMENTATION OF USER-CHARGES

This review of the current charging schemes for roadways and airports and of efficient pricing has led to the following conclusions. In the air sector the uniform user-charge system should be repealed in favour of site-specific user-charges. Furthermore, the current weight-based landing fees are too low for small aircraft (mainly general aviation and corporate aircraft) and too high for large aircraft. This had led to a situation of undercharging the former relative to commercial aircraft (mainly large jet).

Peak-period user-charges should be implemented at airports with congestion problems, and the differential user-charges between peak, low-peak, and off-peak periods can be set to reflect their respective social marginal costs which include congestion externality costs. This leads to a large differential between peak and off-peak fees. Under this system, landing fees for small aircraft become similar to those for large aircraft in the peak periods. It is clear that landing fees for small aircraft at congested airports are even more underpriced. Moving in this direction is highly consistent with the pricing provisions contained in the Transport Canada cost-recovery proposals published in 1990.

A weight-based landing fee, if appropriately set, may be consistent with the Ramsey pricing principle and, thus, have some economic justification for use at small uncongested airports. This is because the demand for airport services by larger (heavier) aircraft is more price-inelastic than smaller (lighter) aircraft. However, the rationale for weight-based pricing breaks down when the airport becomes congested and congestion pricing is applied. Similarly, charging higher landing fees for long-haul international flights at uncongested airports can be justified in an efficient pricing regime since it is consistent with the spirit of Ramsey pricing as the demand for airport services by long-haul flights is less price-elastic than short-haul flights. However, charging higher landing fees for long-haul international flights loses its economic rationale when congestion pricing is applied to congested airports.

In establishing prices for roadways, the empirical studies conducted in Canada and the United States indicate passenger cars and other light vehicles pay a disproportionately higher share of the total road maintenance costs as compared to trucks and other heavy vehicles. The Canadian studies show that the short-run fixed road cost far exceeds the user-charge revenues not related to road usage. This implies that vehicle licence fees may be too low to be optimal, and those who underutilize their vehicles pay less for their option to use the road system than the optimal price for the option to use their vehicle.

Road costs are sensitive to the investment level in capacity and durability. It is therefore important that the road authority make an optimal investment particularly in durability (pavement thickness). In the United States, the underinvestment in durability (that is, building sub-standard roads) has not only substantially increased road maintenance costs more than necessary, but also the costs to the road users.

Currently, the majority of the road user-charges are collected in the form of fuel taxes. Since fuel taxes are not directly related to either congestion or road damage, they are not an efficient means of charging for road usage. Road charges must be related to both road damage and the amount of congestion. Technology now exists for effectively administering congestion tolls either by time of day or by congested road segment. Therefore, the users of urban roads and near-urban highways must be charged both congestion tolls and road damage while users of rural and uncongested intercity roads are charged just for the road damage.

## 6.5 ALTERNATIVE SOURCES OF FINANCING ROAD INFRASTRUCTURE

In practice, a government must use a mix of two or more charging methods to achieve high efficiency in the road transportation sector while attaining a cost recovery target. The road pricing scheme recommended by this study consists of three parts:

- a system of graduated per-kilometre fees for trucks based on axle weight which will improve efficiency in the use of roads and promote an optimal investment in the durability (thickness) of the road system;
- congestion tolls and environmental externality taxes which will help improve the efficiency of the usage of road capacity for urban and near-urban roads as well as achieve an optimal investment in road capacity (lanes); and
- a fuel tax–licence fee combination for cars on uncongested roads.

The relative mix of fixed and variable fees will depend on the relative values of access and usage price elasticities. It will generally be true that a greater proportion of revenues will be generated from the variable charge.

The first two are essentially the social marginal costs of road usage (that is, charging for road damage and externality costs). Construction of toll roads or charging beneficiaries are essentially local financing solutions for specific road construction or improvement projects. Since empirical evidence suggests that a substantial portion of road costs do not vary with road usage (traffic volume or axle loads), use of substantial licence/registration fees is likely to be an efficient means of recovering the fixed road costs if the number of users is not affected by the magnitude of the licence fee. Methodologically, a two-part pricing system can be applied on a national or provincial scale to charge vehicle licence fees for the right to access the road system and social marginal costs (road damage and externality costs) for the road usage. This two-part pricing system is likely to self-finance the Canadian road system.

This study recognizes that motive fuel taxes have been deeply entrenched in society because it is administratively easy to collect large sums of money from road users but also because it helps achieve other important objectives such as environmental and energy conservation goals. However, when planning for 20 or 30 years into the future, the user-charge plans must include economically rational charging methods such as peak-period and peak-district pricing and graduated per-kilometre charges based on axle loadings if there is to be an efficient system.

## ENDNOTES

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1. For the case of a single output with no possibility of effective market segmentation, Ramsey pricing reduces to average cost pricing.

2. Oum and Tretheway (1988) have extended the Ramsey pricing rule to the case where externality costs are present. Their results show that the markup is a weighted average of the inverse elasticity and the ratio of marginal external cost to price.

3. Essentially the same method as Ramsey pricing can be applied to find quasi-optimal prices to achieve a given level of cost recovery (including break even). See Gillen, Oum and Tretheway (1986) for use of the Ramsey framework to compute optimal landing fees subject to various levels of cost recovery for runway services. In the past, some transport economists named it "value-of-service" pricing when firms (airlines and railroads) charged differential (often profit-maximizing) prices for essentially the same services by using differential price elasticities by market segment.

4. The following discussion is in the context of two-part prices but the concepts are not limited to two parts and can apply equally well to multi-part prices.

5. There are a number of examples of two-part prices in the economy: pricing telephone services, golf and other club memberships, amusement parks, roadway access and usage.

6. Train (1991) notes that too high an access fee may result in hardship for lower income groups. If this is perceived as being too inequitable, the efficiency gains may be foregone.

7. See *Aviation Week and Space Technology*, April 27, 1992.

8. Ng and Weisser (1974) have shown that the proportion of the "residual revenue" (the difference between revenue required to break even and the revenue obtained from pure marginal cost pricing) financed by increasing the variable fee above marginal cost, increases with the absolute price elasticity of the number of users and decreases with the absolute price elasticity of the amount of usage.

9. See Ng and Weisser (1974), Spulber (1989) and Train (1991) for further discussions on theoretical and technical issues on multi-part pricing, and its relationship with "block tariffs."

10. Investment to increase slots does not always require a new runway. Construction of a high-speed turnoff, for example, can decrease the amount of time a particular plane occupies a runway.

11. In fact, the landing fee alone is identical in the peak periods for all aircraft types (see Gillen, Oum and Tretheway, 1988).

12. There are numerous studies of urban road pricing and its consequences but they are not reviewed here since the interest is in interurban infrastructure.

13. In all cases the evaluations or comparisons are made against a status quo which is essentially average cost pricing. Thus, the comparison is between average costs and social marginal cost pricing for congested facilities and between average cost and Ramsey pricing for uncongested facilities.

14. Small, Winston and Evans (1989) also developed a set of efficient road prices. These are discussed at greater length later in the section dealing with the question of cost recovery.

15. This was changed in 1991.

16. Since the total disbursements on roads in the United States was $61 billion in 1985 (Small, Winston and Evans, 1989), this means a savings of over 13 percent of the total cost.

17. A recent study in Minneapolis–St. Paul found that the addition of one runway to the international airport would generate such large savings in direct cost to carriers that it (the runway) would have a payback of only three years.

18. Underpricing infrastructure not only leads to excessive use but oversupplying infrastructure leads to long-term structural shifts which almost guarantees today's problems will recur in the future.

19. See Keeler and Small (1977) and Winston (1985) for examples of modelling optimal user charges and investment decisions for infrastructure in such a way as to maximize total benefits for users (social welfare).

20. In the case of a multi-product firm, outputs would be increased in the same proportion or along an output ray.

21. As a corollary, if there are no scale economies, it implies that first-best pricing with no deficit is achievable over the long run.

22. The exception is Air Canada which Gillen et al. (1985) found to have realized most of the available density economies in its network. This may have changed since the empirical evidence is based on data up to 1981 only.

23. Since Canada has a number of small airports in remote communities, indivisibility of capacity at small airports may translate into scale economies.

24. This is one of the significant problems associated with system average costing. It assumes there are not significant differences in costs and demand between facilities.

25. The numbers are also based on costs at the time the study was conducted. The numbers calculated would be as high or lower since lower costs are expected with the move to defederalization (see Hamilton, 1991).

26. Airport planning and construction can in many cases take more than a decade so the characteristics of commercial aircraft soon to be produced are considered in the design.

27. Table 4.1 also shows differential prices by market segment: domestic and international flights. This may be consistent with the spirit of the Ramsey pricing principle considering that most international flights have longer stage lengths and, thus, lower price elasticities of demand for airport services.

28. GA aircraft did pay an airport-specific tax to cover the costs of airport operations but this was not an explicit fee for runway use.

29. As an example of this type of charging structure, New Zealand which has privatized its air traffic control system, charges general aviation aircraft $57 per year (plus sales tax) for the first 50 landings and $3.67 or $4.60 for each subsequent landing depending on airport location (see Paul Proctor, "For Profit New Zealand ATC System Cuts Costs and Increases Efficiency," *Aviation Week and Space Technology*, April 27, 1992).

30. Many of these changes are consistent with a recent Transport Canada pricing policy proposal (Transport Canada, 1990).

31. For example, at Heathrow airport all aircraft, small or large, pay identical landing fees during peak periods. In addition, the combination of landing fees and passenger terminal fees for a large aircraft (for example, Boeing 747) in the peak periods exceeds, by a factor of five, the amount for the same aircraft at off-peak periods. See Gillen, Oum and Tretheway (1988) for the exact fee differentials.

32. Nix allocated costs under two scenarios: with scenario A all capital costs are treated as inescapable (assumed not to vary with vehicle usage). With scenario B one third of the capital costs are assumed to be escapable. Among the capital costs, the pavement costs are allocated to various axle-weight groups, while the road maintenance costs (and one third of the pavement costs in scenario B) were allocated on the basis of vehicle usage. This cost allocation exercise was performed on the following vehicle categories: standard car, three-axle truck, five-axle tractor-semitrailer, six-axle tractor-semitrailer, eight-axle B-train loaded and eight-axle B-train empty.

33. Heggie (1991) categorized the charging instruments into four categories: vehicle usage, vehicle ownership, vehicle acquisition and charging beneficiaries of road system.

34. One exception to this is the case of Japan where substantial revenue from road tolls is generated. Toll revenues accounted for nearly 20 percent of the total revenue collected from road users in 1985. In fact, all three publicly owned road authorities generate financial surpluses after covering capital expansion costs.

35. Small, Winston and Evans (1989) proposed the use of both a steeply graduated per-mile tax based on axle weights and congestion tolls as the main feature of road pricing (pp. 114-19).

36. The Hong Kong experiment is interesting, in part because it is sometimes cited as an example of the failure of congestion charges. Hong Kong did not adopt the congestion toll system after the experiment carried out from 1983 to 1985 primarily because of the complex political factors including people's fears of government intrusion and the desire to exercise the newly won local autonomy from the British governor. However, the test of collection technology in Hong Kong was a resounding success, exceeding by a wide margin the very stringent goals for reliability and ease of use that were established. More than 99.7 percent of vehicles crossing toll sites were correctly identified, and the wrong vehicle was charged less than one time in 10 million.

37. This one-time registration fee may have a small short-run negative effect on the environment since it would discourage the purchase of new vehicles and encourage continued use of older ones. Therefore, it may be desirable to raise annual licence fees substantially without changing the first-time vehicle registration fees.

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## 7

# COMPETITION POLICY AND CANADIAN PASSENGER TRANSPORTATION

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## I. INTRODUCTION

This report examines the effectiveness of the *Competition Act* as an instrument to protect the interests of consumers of commercial air, rail and bus passenger transportation services relative to:

(1) existing direct regulatory controls established by the *National Transportation Act, 1987* (NTA), the *Railway Act* (RA) and the *Motor Vehicle Transport Act, 1987* (MVTA); and

(2) generally, the more interventionist approaches of public utility regulation of prices, profits and products where prior approvals of a government body for some or all of these business activities are required by legislation. State ownership of privately owned commercial passenger transportation services is not examined directly as an alternative regulatory mechanism.

This is a study of the choice of governing instrument where the focus is government intervention to restrict private business choice in situations where unconstrained business choice would not be in the public interest.

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Given that the public interest is multi-faceted and mercurial in a pluralistic democracy, this evaluation must look both at statements of purpose in enabling legislation and the ongoing application of the legislation's standards.

Accordingly this report examines the interrelationship between:

(1) the substantive commercial conduct standards and remedies of the *Competition Act* and other more direct regulatory mechanisms with respect to the passenger transportation sector; and

(2) the institutional and administrative structures for applying these substantive standards and remedies.

The particular aspect of the public interest selected as the focus for evaluation in this study is the "consumer interest." There is, unfortunately, no single pervasively accepted set of standards defining what business conduct is in the consumer interest and what business conduct is not. "Consumer interest" has become a political term to a large extent. The definition of consumer interest selected for this study must therefore be somewhat arbitrary and it certainly will not please everyone.

This study assumes that the consumer interest comprehends maximizing product choice and innovation and minimizing opportunities for businesses to be less than fully efficient in the supply of their products.

In this context, achieving fair prices through internal cross subsidization is regarded only as a means to achieve maximum consumer choice and business efficiency and not as an end in itself.

Inclusion of social goals or income distribution, policy-pricing objectives as a necessary and important aspect of the consumer interest would, therefore, result in considerably different analysis and results. As discussed below, in parts II, III and IV, fair or politically motivated pricing is not an objective of the *Competition Act*. However, existing passenger service regulation creates both the incentive and the opportunity to establish prices based predominantly on fairness and social policy either directly or through controlling exit and entry.

It should, however, be noted that unregulated markets are rife with prices that are established not just to cover marginal costs. There are other pricing considerations related to sales maximization, stimulating demand for a firm's complementary or related products, administrative convenience, and maintenance of good customer relations. From the economist's strict marginal cost pricing perspective, all these can contribute to unregulated supplier price structures which display stability and geographical uniformity and which entail an element of internal cross subsidization.

Private markets regulated only by the *Competition Act* can and do deliver price structures that are fair, stable and, to some degree, geographically uniform in consumers' eyes. Such markets do not, however, deliver price structures that involve substantial redistributions of wealth geographically between particular income groups.

To summarize, this report examines alternative regulatory instruments in relation to their capacity to facilitate maximum consumer choice and business efficiency in the supply of commercial passenger transportation services. It does not look at their capacity to function as taxation and subsidization instruments.

## II. COMPETITION ACT

### A. OVERVIEW

The *Competition Act* is general legislation of general application founded principally upon the federal trade and commerce power. Criminal prohibitions in the Act against agreements to lessen competition (the original focus of Canadian competition law) have also been supported by the federal criminal law power.

The legislation is enforced by the Director of Investigation and Research (DIR), a Governor in Council appointee responsible to the Minister of Consumer and Corporate Affairs. In practice, the DIR's office, known as the Bureau of Competition Policy (Bureau), operates with a measure of independence from political control similar to a combination of a provincial police force and Crown Attorney's office. The DIR is responsible for the conduct of all formal inquiries into possible criminal offences and practices reviewable by the Competition Tribunal and for making applications for remedial orders to the Competition Tribunal. Criminal matters are generally referred to the Attorney General for Canada for the laying of charges and prosecution, but the Attorney General's Agent generally consults closely with the DIR on these matters. The DIR reports annually to Parliament through the Minister.

The legislation has been broadened, refined and clarified a number of times over its 100-year history, with the most recent and comprehensive revision in 1986. The 1986 revisions:

(1) clarified the conspiracy prohibitions in relation to the case law and expanded opportunities for lawful export agreements;

(2) established the Competition Tribunal (to replace the Restrictive Trade Practices Commission (RTPC)) as an expert quasi-judicial body comprising Federal Court judges and business and economics experts to adjudicate reviewable practices. (The Competition Tribunal is purely an adjudicative body and, unlike the RTPC, does not have the capacity to support DIR inquiries or conduct fact-finding inquiries into monopolistic practices);

(3) revised the Act's investigative powers to comply with the *Canadian Charter of Rights and Freedoms*;

(4) substituted new reviewable practices respecting mergers and abuse of dominant position for ineffective criminal law prohibitions against mergers and monopolies;

(5) introduced new reviewable practices respecting systematic delivered pricing and specialization agreements;

(6) established a new purposes section to guide administration of the Act by both the DIR and the Competition Tribunal; and

(7) established a new requirement to notify the DIR of mergers above a certain threshold to assist in enforcement of the merger provisions.

As noted, the substantive standards of the *Competition Act* comprise both criminal law prohibitions administered by the provincial superior courts, and reviewable practices over which the Competition Tribunal h[illegible] sole jurisdiction to issue remedial Orders.

The principal criminal prohibitions, that is, offences in relation to competition, relate to:

- agreements to lessen competition unduly in a market;
- bid-rigging;
- resale price maintenance;
- price discrimination among competing purchasers;
- predatory pricing; and
- misleading advertising.

Matters reviewable by the Competition Tribunal include:

- non-price vertical restraints (refusal to deal, consignment selling, tied selling, market restriction and exclusive dealing) engaged in by major participants;
- abuse of dominant position which substantially lessens competition in a market;
- systematic delivered pricing;
- specialization agreements; and
- mergers which substantially lessen competition in a market.

These categories are not entirely self-contained. It is possible to maintain an abuse of dominant position application using evidence of predatory pricing or non-price vertical restraints, and it is possible to support a merger application based upon increased prospects for post-merger cartelization or abuse of dominance.

The foundations of Canadian competition law, in my view, are the prevention of:

(1) inefficient monopolization or increased market concentration whether through acquisition or horizontal agreement; and

(2) exercising of market power to exclude competition in primary markets, in secondary markets or in new markets, whether through pricing or contractual practices.

These are also the basic objectives of competition law throughout the world.

Maximizing competition is viewed as a necessary and a generally sufficient condition to maximizing consumer welfare in the classical economics literature.

Notwithstanding the classical economics underpinnings of the *Competition Act*, the 1986 revisions established a more human and accessible face to the law through a new purposes provision (section 1.1):

> The purpose of this Act is to maintain and encourage competition in Canada in order to promote the efficiency and adaptability of the Canadian economy, in order to expand opportunities for Canadian participation in world markets while at the same time recognizing the role of foreign competition in Canada, in order to ensure that small and medium-sized enterprises have an equitable opportunity to participate in the Canadian economy and in order to provide consumers with competitive prices and product choices.

Under the regulatory intervention model of competition law, markets are presumed to be functioning properly unless certain standards are breached. In such cases, the State is considered to be entitled to intervene to remedy a defined problem. The remedy can be justified in lasting only long enough to eliminate the problem and to restore adequate competition in the market. The remedy is imposed by the courts or an adjudicative body; it is not legislated.

As a result, the application of competition law remedies occurs in a strongly contested adjudicative environment where the person(s) against whom the remedy is sought have extensive rights to challenge the government position. In the event a remedy is authorized, they may return at their own instance to the adjudicative environment to seek modification or elimination of the remedy if it can be shown to be no longer effective or even counter-productive.

Debate on the relative merits of competition law and more interventionist direct regulatory instruments, therefore, turns not so much on the structural coverage and efficiency of competing instruments to remove consumer harms once the State acts, but on competing political or even ideological visions on the appropriate relationship of the State and private business.

Competition law, with its built-in presumptions that the onus is on the State to prove that focussed intervention is justified in the eyes of an impartial adjudicator on a case-by-case basis, strikes a political or ideological chord with those who contend that government intervention in business decision-making is inherently counter-productive and that social goals should be achieved through taxation, subsidization and the State supply of pure public goods, that is, products which society demands but which private markets fail to supply. Competition law also finds favour with those who believe that general legal standards can and will be followed by business without direct and specific State instruction, and that there is a tangible general deterrent effect of obtaining litigated remedies against participants in the economy.

Direct regulation, on the other hand, is supported by those who consider that private enterprise, because of pervasive market imperfections including imperfect information, imperfect price signals and a myriad of supply rigidities, can and should generally benefit from State guidance or even control of business management. Direct intervention is also favoured by those who consider that it is not feasible to construct general economic conduct laws that provide useful standards for action by particular businesses.

This political or ideological cleavage becomes particularly pronounced in an examination of the role of the State in relation to the supply of products which are important to all consumers: food, housing, transportation, communications and energy. The ideological gap is even more evident when the inputs required to produce these products include a high proportion of priced or unpriced products supplied by the State, that is, public goods.

This report, however, does not attempt to address or reconcile these political or ideological differences in examining the relative effectiveness of the *Competition Act*. Rather, the analysis flows from the author's perspective that competing governing instruments should be evaluated solely upon their *a priori*, or demonstrated, capacity to achieve certain objective performance standards.

## B. SCOPE OF COVERAGE

The *Competition Act* is a general law of general application. The key terms of the Act (product, business, supply, trade, industry profession) are defined with maximum breadth and flexibility. However, its application to economic conduct in Canada is not universal. Statutory and common law rules limit its application.

With respect to passenger transportation services, the key limitations relate to both government and regulated private sector conduct.

### 1. Statutory Exemptions

Given the constitutional underpinnings of the *Competition Act*, it is generally accepted that only validly enacted federal legislation may expressly exempt an activity from the operation of the *Competition Act*. The instances in which Parliament has elected to limit the scope of the *Competition Act* are few and far between.

Agreements among shipping conference members are exempted from the conspiracy prohibition of the *Competition Act* if certain conditions are met by operation of the *Shipping Conferences Exemption Act, 1987*. The *Competition Act* itself contains certain limited exemptions relating to activities that need not be considered for the purpose of this report. The *Farm Product Marketing Agencies Act* also contains an express exemption with respect to the conspiracy prohibition.

### 2. Common Law Exemptions

#### *(a) Crown Agency*

It is a general rule of statutory interpretation applied by the courts that an enactment is not binding on the Crown or its agents unless the enactment expressly says that it is. Crown agency status may be expressly granted by valid legislation of the federal government or a province, or it may be a constructive agency arising from the facts — the actual relationship between a person and the Crown.

This principle has been applied by the courts to the *Combines Investigation Act* (the predecessor legislation to the *Competition Act*) with respect to prosecutions under the Act's criminal conspiracy provisions (*R. v. Eldorado Nuclear Ltd.*, [1983] 2 S.C.R. 551, 4 D.L.R. (4th) 193). It is also established that this principle applies equally to federal legislation of a non-criminal and regulatory nature founded upon the federal trade and commerce or interprovincial undertakings power, for example, *Alberta Government Telephone v. CRTC* (1989), 61 D.L.R. (4th) 193 (SCC).

The *Competition Act* expressly applies to Crown Agents that are corporations *but only* to the limited extent set out in section 2.1 of the Act:

> This Act is binding on and applies to an agent of Her Majesty in right of Canada or a province that is a corporation, in respect of commercial activities engaged in by the corporation in competition, whether actual or potential, with other persons to the extent that it would apply if the agent were not an agent of Her Majesty.

Therefore the *Competition Act* does not apply to, and would not be a substitute for, valid regulatory legislation affecting:

(i) the federal and provincial Crowns themselves acting other than through a corporation; and

(ii) federal or provincial Crown corporations which are either not engaged in commercial activities or are not engaged in activities which are in actual or potential competition with other persons in Canada.

Stated another way, without new federal legislation expressly making the *Competition Act* applicable, the *Competition Act* currently does not apply to:

(i) commercial activities conducted by federal or provincial government departments;

(ii) activities of Crown corporations that are not regarded by the courts or the Competition Tribunal (depending upon the activity in question) as being "commercial activities." (There is no definition of commercial activity in the *Competition Act*, and the Bureau of Competition Policy has provided no administrative guidance to date with respect to its interpretation of this term); and

(iii) commercial activities of a Crown corporation which are not engaged in competition with others. (Again, there is no statutory or judicial amplification of what constitutes a non-competitive commercial activity, but presumably this might include the monopoly supply of products in a given market. From the wording of section 2.1, it is possible to argue that only actual and not potential competition is relevant.)

These restrictions clearly have implications for the effectiveness of the *Competition Act* where governments consider the privatization, devolution, contracting out or pricing of elements of the transportation system which have heretofore been supplied by government departments as pure or priced public goods. Such elements include airport landing slot or runway access, road access or use, provision of navigational services and the provision of regulatory inspection services. Accordingly, we will examine the concept of Crown agency more fully in Part V of this report.

### *(b) Regulated Conduct*

It is a well-established principle that business conduct that is required or authorized by validly enacted federal or provincial legislation is not subject to the *Competition Act* (unless the legislation also expressly makes the *Competition Act* applicable). There is some debate as to whether this doctrine is, in effect, a constitutional doctrine based upon paramountcy considerations rendering application of the *Competition Act* invalid in principle; or whether it amounts instead to a regulated conduct defence whereby no sanction or remedy will be issued if the accused (or the respondent as the case may be) demonstrates as a matter of fact that an element the federal government must prove cannot in the circumstances be proven because the accused relied upon prior government requirements or approvals.

This is by no means a purely academic legal distinction. If the regulated conduct doctrine is quasi-constitutional, then both the inquiry and remedial powers of the *Competition Act* do not apply to a particular industry or activity, and efforts to amend the Act to expand its scope, and thereby to trench upon provincial or federal activities from the trade and commerce power base of the legislation, would be ineffective. Equally the provinces could essentially enact *any* regulatory legislation that would otherwise be valid under provincial heads of power to ensure that the *Competition Act* could not apply to the subject activity. Probably such provincial action could extend only to intra-provincial activities. The leading case in support of this constitutional perspective is *A.-G. Canada v. LSBC,* [1982] 2 S.C.R. 307, 137 D.L.R. (3d) 1.

If there is only a regulated conduct defence, then the inquiry powers of the Act would still be valid and the courts or the Competition Tribunal, as the case may be, would have greater scope, first, to ascertain whether the regulatory scheme was effective in requiring the impugned behaviour, and, secondly, where the behaviour was merely authorized, to weigh the relative merits of allowing or not allowing the defence in relation to the goals of the competing legislation. The leading case favouring this approach is *R. v. Canadian Breweries Ltd.* (1960), 126 C.C.C. 133, [1960] O.R. 601, 33 C.R. 1 (H.C.J).

In this context both the LSBC and the Canadian Breweries cases determined the applicability of criminal prohibitions of the former *Combines Investigation Act*. There have been no successful constitutional challenges to date regarding the reviewable practices provisions of the *Competition Act* which are exclusively founded upon the federal trade and commerce power. As well, recently, the Supreme Court has been more open-minded in determining the scope of the trade and commerce power. In *A.-G. Canada v. C.N. Transportation Ltd.*, [1983] 2 S.C.R. 206, 3 D.L.R. (4th) 16, the Court upheld the validity of the non-price vertical restriction practices of the Act and ruled that they were not an excessive invasion of the provincial property and civil rights domain.

Nevertheless, the regulated conduct doctrine is the basis for defining the applicability of the *Competition Act* in relation to the regulation of commercial passenger service entry, exit, merger and price. In my view, the current state of the law in relation to this boundary is as follows:

(i) It is now uncertain whether licensing requirements for *entry or exit or ownership* based on economic (that is, public interest, or public convenience and necessity) considerations as opposed to commercial fitness criteria (that is, fit, willing and able) could by themselves make the merger or abuse of dominant position provisions of the Act inapplicable to the subject industry. However, licensing and merger approval involving detailed conditions or performance requirements which clearly constrain business behaviour would very likely make the merger and abuse of dominance provisions inapplicable at least with respect to a case based upon a lessening of competition in the activities caught by the conditions or performance requirements.

(ii) *Price approval requirements or a power of price disallowance* coupled with statutory pricing standards in regulatory legislation would make the predatory pricing and price discrimination provisions of the *Competition Act* inapplicable to unilateral pricing activities of regulated companies. However, low pricing, even if sanctioned by a regulator, could still constitute anti-competitive practice for the purpose of establishing abuse of dominant position.

(iii) The *conspiracy prohibitions* of the Act may be inapplicable only where the impugned agreement or arrangement is specifically required or authorized as part of an otherwise valid regulatory scheme, or the agreement or arrangement is necessary to the achievement of valid regulatory purposes.

(iv) For substantive provisions of the Act apart from conspiracy, abuse of dominant position, predatory pricing and merger, there is no regulated conduct defence or exemption for regulated industries.

## C. ENFORCEMENT POWERS AND PRACTICES

Inquiries by the DIR may be either informal or formal, with the boundary line being somewhat unclear.

An informal inquiry technically becomes a formal inquiry where:

(1) the DIR has received a six-resident complaint in proper form as required by section 9 of the Act;

(2) the DIR has reason to believe that grounds for a remedial order exist or an offence under the Act has been or is about to be committed; or

(3) a formal inquiry is directed by the Minister.

The Act requires all formal inquiries to be private and, in practice, all informal inquiries are conducted also in private.

Most inquiries (with the possible exception of merger inquiries) are based upon complaints from competitors, suppliers or purchasers. Because of the Act's privacy requirement, complainants are not kept abreast of the inquiry they have initiated and may not be involved (except with the consent of the subject of the inquiry) in negotiations directed at an out-of-court settlement.

The Act provides special, superior court-supervised information-gathering powers to support formal inquiries which are subject to judicial supervision. These include powers to search and seize and to require oral examination, production and written returns.

The inquiry process is generally time consuming. There are no statutory deadlines that must be observed. Some major conspiracy inquiries have taken several years before charges were laid. The inquiry stages of the three predatory pricing cases that have gone to trial under the criminal provisions of the Act took many months, nor was interim prohibition sought to stop the alleged predatory conduct, as is provided for in the Act. Recently, reviewable practices inquiries have taken several months to a year before applications were filed with the Competition Tribunal.

Merger inquiries are, however, fast-tracked to ensure that the parties know whether the DIR intends to challenge the merger before its implementation.

The adjudicative process has also proven to be fairly time consuming. The determination of criminal charges (apart from those arising from misleading advertising and resale price maintenance) has often taken from one to several years. This is the case in part because of the criminal law requirement for a preliminary inquiry and a high incidence of procedural and Charter challenges raised by those accused. Recent Competition Tribunal proceedings have ranged from 12 to 18 months from application to decision.

Because of the costs and uncertainties of the inquiry and adjudicative process, the DIR in particular, but also the parties to the inquiry, have strong incentives to reach out-of-court settlements. Settled court-approved prohibition orders with respect to criminal conspiracy inquiries and informal merger undertakings have been increasingly prevalent in the last five years. Less frequently, the DIR has sought Competition Tribunal approval of a merger agreement (*DIR v. Palm Dairies Ltd.* (1986), 12 C.P.R. (3d) 540 (Comp. Trib.) and *DIR v. Imperial Oil Ltd.* (unreported Comp. Trib. decision, February 6, 1990), CT-89/3). One disputed merger, *DIR v. Air Canada* (1989), 27 C.P.R. (3d) 476 (Comp. Trib), resulted in a consent agreement following the application to the Tribunal but before trial.

Complainants have limited opportunity to participate in trials under the Act. In criminal matters complainants may only participate as witnesses, usually for the Crown. In reviewable matters, the Competition Tribunal has the discretion to allow third-party interventions (*American Airlines v. Canada (Comp. Trib.)*, [1989] 2 F.C. 88, 23 C.P.R. (3d) 178, 54 D.L.R. (4th) 741 (C.A.), affd [1989] 1 S.C.R. 236) but has been fairly tough in attaching conditions to intervener participation. These conditions include having to ask the DIR to call certain evidence before being allowed to do so, and avoidance of repetitive cross-examination. On the other hand, intervener participation in hearings to approve the Imperial/Texaco merger conditions and the Reservec merger case was thorough and extensive. These competitor interventions had considerable impact on the outcome.

The most severe criticisms of the *Competition Act* are directed, not surprisingly, at the inquiry and adjudicative processes of the regime, and not at the Act's substantive standards. They relate to the secretiveness of the inquiry process, the very long time from complaint to result, the low incidence of complaint-induced results, and the lack of complainant opportunity to participate in inquiries or in adjudication.

In short, justice is not seen to be done, and justice delayed is justice denied (especially when the acts in question have affected the market before the DIR appears to do anything). Criticism is also focussed on the inadequacy of the government-led anti-trust machinery because, unlike the U.S., there is no tradition (and little apparent opportunity or incentive) for private anti-trust enforcement. In the U.S., private anti-trust suits by far outweigh government suits — a reflection to some degree of the availability of treble damages and contingency fees.

However, within a broad range, it is possible to reform the inquiry and adjudicative process without undermining or affecting the substance of the law. It might also be possible to restructure a large part of the criminal law substance of the Act as civilly reviewable practices given the clear overall current foundation of the law on the trade and commerce power.

## III. *COMPETITION ACT* — PRINCIPAL JURISPRUDENCE

### A. INTRODUCTION

In light of the inquiry and adjudicative process, it should not be surprising that there is a very low volume of case law relating to the key provisions concerning monopolistic and cartel behaviour. There is also a dearth of case law relating specifically to the transportation sector.

This section examines the core provisions of the Act that interface with direct regulatory schemes. They are:

- predatory pricing;
- conspiracy;
- merger; and
- abuse of dominant position.

The analysis covers recent judicial and Competition Tribunal decisions. In the case of merger and predatory pricing, recently published proposed, DIR enforcement guidelines are discussed in detail. With respect to conspiracy, the focus is more on the substance of recent prohibition orders agreed to in lieu of trial. Two important recent prohibition orders relate to the used household goods transportation industry, and the for-hire general trucking industry in Western Canada.

The published DIR analysis of the clearance of the CAIL/Wardair merger sheds some light on merger review. It should be noted that the National Transportation Agency and the Competition Tribunal have concurrent jurisdiction over airline mergers.

In addition, the Reservec/Gemini merger proceeding addresses, through a transportation service, the application of competition law to the consequences of mergers establishing control over the supply of essential or "bottleneck" inputs consumed by them and their competitors.

On the other hand, there are no reported Canadian competition law decisions or settled cases relating specifically to the passenger transportation sector where the DIR has actually challenged industry conduct using the enforcement machinery of the Act. The DIR has, of course, been a strong proponent of economic deregulation of this sector (with some particular success in air transport policy) and has also advocated privatization and pricing of quasi-public goods as necessary steps to establish self-sustaining and efficient markets in the supply of these services.

## B. PREDATORY PRICING AND PRICE DISCRIMINATION (PARAGRAPH 50(1)(C) OF THE *COMPETITION ACT*)

### 1. Introduction

Section 50 of the *Competition Act* establishes three separate but related criminal offences addressing unilateral pricing behaviour.

The Act's *predatory pricing* standard provides:

> Everyone engaged in a business who . . .
>
> (c) engages in a policy of selling products at prices unreasonably low, having the effect or tendency of substantially lessening competition or eliminating a competitor, or designed to have that effect,
>
> is guilty of an indictable offence and liable to imprisonment for a term not exceeding two years.

Section 50 also contains prohibitions against *price discrimination* in sales of "articles" to competing purchasers, and against *geographic price discrimination* which substantially lessens competition.

Although the price discrimination offence is restricted to sales or articles, article is defined in the Act to include tickets or like evidence of a right to transportation. The price discrimination offence therefore, in my view, applies to sales of transportation services. However, as noted, the discriminatory sales must be to competing purchasers. This requirement has been interpreted consistently by the Bureau of Competition Policy to mean purchasers which compete with each other in the product they produce, or purchasers which are major purchasers of an article in limited supply.

Neither test for competing purchasers would appear to apply realistically to the sale of passenger transportation services with the exception of sales or services to brokers, wholesalers or retail resellers (for example, tour operators, travel agents) who compete in the same product or geographic market.

Accordingly, this report does not focus on the price discrimination prohibition except to note that it has limited applicability to the passenger service intermediary sector. It should not, in its present form, be regarded as a means of preventing price discrimination at the retail level of the direct sale of commercial passenger services.

In addition, section 50 as presently drafted does not apply to price discrimination in sales of transportation services to discrete geographic monopolies.

Nor, and this is the principal limitation of the section, does this prohibition apply to the sale of services which are inputs to, or products of, commercial passenger transportation service suppliers. For example, the price discrimination prohibition would not apply to the pricing of computerized reservation services or travel services such as car rentals or hotels packaged with commercial passenger transportation services.

The geographic price discrimination offence has not been applied on a stand-alone basis. Complaints of geographical price discrimination are examined by the DIR in the context of either predatory pricing or abuse of dominant position.

It is too early to tell whether the predatory pricing offence will stay separate for enforcement purposes, as it is possible to structure a predatory pricing case involving a dominant firm (the only kind of firm that economic theory suggests would have the incentive and ability to predate successfully) as an abuse of dominance case. This would mean that the criminal standard of proof would be avoided, and the hearing would be before an expert tribunal.

The history of predatory pricing charges (three trials, two not guilty findings, one conviction where the price was zero,[1] and an apparent incapacity of the courts to focus individually on the elements of the offence, thus providing no useful guidance to the Bureau or to producers) would suggest that the Bureau may well prefer to pursue predatory pricing issues before the Competition Tribunal in the future.

The history of predatory pricing charges and inquiries over the last 20 years also suggests that Canadian competition law authorities have been affected by the strong criticism levelled by senior U.S. economists against the presumption of the offence that firms (even dominant ones) have an incentive and an ability to increase long-term profits through predatory pricing, regardless of what production cost-based price floor for the determination of "unreasonably low prices" may exist. As this critique goes, predatory pricing might result in a long-term loss of consumer welfare only where the industry is subject to significant long-term barriers to entry.

This uncertainty has, in my view, been reflected in the draft Predatory Pricing Bulletin discussed below.

The following discussion of the Bureau's proposed predatory pricing enforcement policy can also be applied to Bureau enforcement of the abuse of dominant position provision where the focus is the unilateral pricing behaviour of the dominant firm.

In addition, and perhaps more important, those same criteria that are presented in the draft Predatory Pricing Bulletin to determine whether structural market conditions exist to exercise short-run market power could be used by the Bureau to assess the related issues of market dominance and substantial lessening of competition under the abuse of dominant position provisions.

### 2. Draft Predatory Pricing Bulletin

In April 1990, the Bureau circulated for public comment a draft Bulletin laying out its enforcement policy with respect to the predatory pricing offence of the *Competition Act.*[2]

The Bulletin notes at the outset that there is very limited jurisprudence on the interpretation of this provision and that, in the past, the Bureau has provided little public guidance on its enforcement policy regarding predatory pricing.

The Bulletin restyles the predatory pricing offence somewhat by defining it as the sale of products at prices so low as to cause injury to competition through the elimination of a competitor or the deterrence of entry or expansion of a competitor. Injury to competition is defined as a situation where the alleged predator is regarded as having a reasonable expectation of recouping any of the profits foregone by its low pricing conduct. Accordingly, the Bulletin notes that instances of true predatory pricing are usually rare and would be limited to markets with specific structural characteristics that allow the alleged predator to increase prices without fear of encouraging effective competitive entry in response.

The Bulletin proposes a *two-stage screening exercise* to determine whether these requisite structural characteristics are present. Because of the emphasis on market structure, elimination of a competitor or evidence of intent to do so generally would not be sufficient on their own to cause the DIR to exercise enforcement.

The *first stage* of the screening process is an *assessment of the degree of short-run market power possessed by the alleged predator.* This includes an examination of whether the entry and exit conditions in the relevant market might permit that firm to recoup losses caused by predatory pricing. The Bulletin makes it clear that, if such market conditions do not exist (that is, the alleged predatory firm is presumably only harming itself and not the alleged victim of predation in the market), the matter will not be pursued.

The second stage of the screening process examines *the pricing policy of the alleged predator in relation to cost information* and would come into play only if the Stage I market conditions have been satisfied.

The first task in Stage I is to define, through objective measures, the market power of the alleged predator. As a preliminary step, the relevant product market would be defined by examining both current and potential substitutes for the product whose prices are being examined. The geographic market would be established by an examination of consumer options for relocating their purchases in the event of significant price increase. For a predatory pricing inquiry to proceed, the alleged predator must have sufficient short-run market power to restrict output and raise prices through unilateral conduct.

The principal measures proposed by the Bureau for examining market power are the market share of the alleged predator; the measures of concentration in the relevant industry; the overall number and distribution of firms serving the relevant market; and the volatility of market shares of these firms. As a rule of thumb, the Bureau has proposed that the alleged predator must have at least a 35 percent share of the relevant market and be at least twice as large as its next largest competitor.

The Bureau has indicated that it would be unlikely to pursue any action against unilateral pricing conduct of a firm falling below these two thresholds. On the other hand, if a firm meets these criteria, the Bureau would still consider other factors before determining whether to pursue the matter. As indicated by the Bulletin, such factors include the history and practices of the alleged predator, its overall size and financial strength, and any special advantages resulting from government intervention in the marketplace. Consideration would be given to whether the alleged predator is an incumbent firm or a new entrant.

In the Bureau's view, incumbent firms are more likely to engage in predatory pricing as they are more likely to have the incentive and ability to predate than do smaller entrants and may be in a better position to identify strategies to disadvantage their rivals.

This emphasis on relative market power as the initial screening device is consistent with the traditional notion that true anti-competitive low pricing will be practiced only by a significant incumbent firm to keep out vigorous new firms into its established market. In this initial stage, much will turn, therefore, on the definition of the relevant market. If the geographic and product markets are relatively narrowly defined in practice, this initial screening measure may persuade the Bureau to ignore low pricing behaviour by dominant or multi-product firms entering new markets with the objective of dominating those markets.

The second aspect of the first stage is an examination of conditions of entry and exit in the relevant market. The Bulletin notes that, for low pricing not to be a concern, the market must display the prospect of "effective entry," that is, not simply theoretical entry but whether "timely, sufficient" entry is likely. When both effective entry and exit are easy, the Bulletin contends, the initial low price behaviour of a firm's short-run market power will not be viewed as a threat to the competitive process. The following factors would be examined by the Bureau to determine whether the conditions for effective entry are present in that particular market.

*(1) Speed of entry:* This is regarded as the essential element for effective entry and the major focus of the Bureau's analysis. Speed of entry is defined to be the time required between identifying a business opportunity and selling in the relevant market. The Bulletin proposes that, as a general rule, a market is not exposed to effective entry if the minimum time required to enter exceeds 18 months. Accordingly, entry that would take several years

to accomplish would not deter or prevent "supra-competitive pricing" by a firm possessing market power once its low pricing policy achieved its short-term results of reducing competition.

*(2) Sunk costs:* These are investments the value of which could not be recovered in the event of business failure because they are either highly specialized or are not liquid. High sunk costs increase the financial risk of entry and reduce the expected short-run profitability upon entry.

*(3) Economies of scale and scope:* Economies of scale refer to the reduction of unit costs from increased volume of a firm's output. Economies of scope refer to reduction of unit costs through the production of products jointly rather than individually. The two concepts are, in practice, inseverable for large multi-product firms. The presence of these elements is considered essentially a supplementary factor shading the analysis in the favour of conclusion that barriers to entry exist if there is evidence of low speed of entry and/or high sunk costs.

However, it is hard to see why the Bureau would consider the presence of economies of scale and scope as evidence of predatory pricing behaviour. Predatory pricing laws have been criticized for discouraging pricing innovations which would make a firm more efficient through economies of scale and scope. Predatory pricing laws are not supposed to penalize efficient firms for undercutting the prices of inefficient firms, particularly where excess capacity exists or where efficiency increases with a firm's level of output.

In a technical sense, economies of scale and scope create a barrier to new entry. To become an efficient competitor, the new entrant must be capable of achieving the production volumes of the largest and hence the most efficient firm in the market. But, *if* in achieving its market foothold, the new entrant incurs higher unit costs than the established competitor, and the established competitor's output decreases while its unit costs increase, and *if* the Bureau's approach to predatory pricing inhibits incumbent pricing that may force out the less efficient new entrants, it is possible that industry efficiency and consumer welfare will end up in second place to the objective of increasing the number of visible competitors in the market.

Two examples are provided to explain why economies of scale and scope might count against an alleged predator. First, the Bulletin suggests that large-scale projects may require time-consuming plant construction that goes well beyond the period required by the predator to recoup any losses incurred from its predatory behaviour. However, if the new plant is more efficient than the predator's plant at a given level of output using average prices over the predation and post-predation time periods, the manner in which construction or start-up costs are accounted for should not matter. The more efficient plant should be built if it can produce at costs below that average price. If up-front accounting costs do matter, this arguably reflects more on imperfections in financial markets and accounting techniques than on possible market failure through predatory pricing.

The Bulletin also suggests that the entry may not be effective because of difficulties in overcoming brand loyalty. Arguably, brand loyalties have nothing to do with economies of scale and scope; rather, they represent imperfections of consumer information or simple consumer unpredictability or irrationality on the demand side of the market as opposed to the supply side (which side is more germane to determination of predatory pricing).

It is possible that the Bureau may reconsider the weight attached to economies of scale and scope in its Stage I analysis.

Finally, several other factors are mentioned as possible impediments to effective entry including institutional (patent, tariff or regulatory) barriers, established contractual arrangements of incumbent firms, and control over inputs by incumbent firms. The Bulletin also mentions that a firm with market power might signal to potential competitors that the market is unprofitable by pricing conduct, thus discouraging interest in the market.

In the event that this Stage I analysis reveals "a potential danger of effective predation," the Bureau would proceed to the second stage which involves an examination of price-cost relationships. The Bulletin emphasizes that no single price-cost test or criterion would be employed. In a restatement of the jurisprudence with respect to unreasonably low prices, the Bulletin suggests that whether certain prices are predatory depends on factors such as the duration of the period in which the low prices are maintained, whether they are adopted unilaterally or as a response to pricing policies of competing firms, and the underlying intent of the alleged predator.

Three general rules (again derived from the jurisprudence) are presented. First, a price at or above the average total cost incurred by the alleged predator is unlikely to be regarded as predatory. Secondly, a price below the average variable costs of the alleged predator is likely to be treated as predatory, unless there is clear justification. And thirdly, a price below the alleged predator's average total cost but not lower than its average variable cost (the "grey range") may or may not be treated as predatory depending on the circumstances.

These circumstances could include the intent of the pricing policy, the costs and financial weakness or strength of the target firm(s), the feasibility of re-entry of the market indicated by the Stage I analysis, the existence of excess capacity, and general demand conditions prevailing in the market.

In adopting this modified form of a variable cost threshold for anti-competitive prices, the Bureau has unfortunately provided only thin guidance to industry on how to determine variable costs. How the Bureau would determine these costs has also been left unclear since it would appear that the only way the Bureau could obtain useful evidence of the alleged predator's variable cost would be through the exercise of formal investigatory powers following the initiation of a formal predatory pricing inquiry under the *Competition Act* rather than in the course of a pre-inquiry screening analysis.

The Bulletin notes that variable costs include costs that may be varied with levels of output, including labour, material energy, promotional allowances and use-related plant depreciation.

With multi-product firms, of course, the exercise of identifying direct and indirect variable costs with particular product lines and output changes has proven to be a very difficult and often arbitrary exercise. No specific guidance is provided on the appropriate principles of common or joint cost allocation. The Bulletin offers no guidance with respect to the period of time over which the variability of particular input costs with levels are to be determined. Over a sufficiently longer period of time, of course, all costs are variable. Needless to say, no conventional cost-accounting framework provides a guarantee that all costs can readily be causally related to variation in a particular product line's output, even though all budgeted costs vary to a degree with the budgeted revenues of a firm.

The Bulletin does indirectly suggest that fixed costs include costs associated with investment in plant and machinery and fixed assets. On the other hand, the Bulletin suggests that "use-related plant depreciation " is a variable cost. It is hard to determine the Bureau's boundary line between fixed and variable costs. In practice this distinction can vary considerably according to the parameters of the cost analysis employed.

Moreover, many firms' physical facilities and machinery can be incremented easily within the 18-month period established by the Bulletin for assessing likely effectiveness of entry. Such plant investment may be traced to specific product lines or addition of volumes produced in existing product lines. Are these costs fixed or variable?

To cloud the picture further, the Bulletin suggests that its cost analysis would also be based on "reasonably anticipated rather than actual variable costs." The question arises then as to whether the Bureau, for whatever time frame it selects to analyze the predatory behaviour, might unilaterally impose adjustments to the existing or recorded cost structure of the alleged predator. These adjustments might be based on, for example, inflation and increased excess capacity caused by a loss of market share from successful entry by the alleged victim of the predator's pricing conduct or, alternatively, the Bureau might cost assets at their current replacement cost as opposed to their recorded historical and depreciated cost.

Finally, the Bureau suggests that its price-cost analysis need not be restricted to a static analysis. It may take into account the possible future cost structure of incumbent firms if additional plant capacity is built in response to entry by the alleged victim of predatory pricing. Consequently, the Bulletin suggests that the timing of plant increments in relation to new entry would be a relevant consideration. The application of hypothetical costs from yet to be built or newly on-stream capacity increments, particularly where production technology is changing, may further complicate the price-cost analysis. This, in turn, will further reduce the ability of business planners to anticipate the reaction of the Bureau to low pricing conduct should a matter reach Stage II of the Bureau's preliminary analysis.

The Bureau has also indicated that, in any event, it does not intend to be bound to the results of whatever cost test it applies. Where prices are below the average total cost but above the average variable cost (the most likely outcome), the Bureau would take into account the surrounding circumstances. These could include the intent of the pricing policy, the costs and financial weaknesses or strengths of the target firm(s), the feasibility of re-entry to the market as revealed in the Stage I analysis and the existence of excess capacity and general demand conditions prevailing in the market.

To ensure that the potential for certainty is clouded, the Bulletin then concludes that the inferences drawn will depend directly upon the apparent purpose of the low pricing and its reasonableness in light of the facts. (p. 12)

Thus, having apparently rejected the subjective, or intention-driven, aspect of the offence in favour of an objective, structural- and cost-driven analysis at the outset of the Bulletin, the Bulletin reintroduces intention as a critical swing variable in determining whether to pursue cases in the grey range of the Stage II analysis.

## C. CONSPIRACY

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### 1. Introduction

The core of the *Competition Act* is the criminal prohibition against agreements or arrangements to lessen competition unduly. The Act states:

> 45.(1) Every one who conspires, combines, agrees or arranges with another person
>
> (a) to limit unduly the facilities for transporting, producing, manufacturing, supplying, storing or dealing in any product,
>
> (b) to prevent, limit or lessen, unduly, the manufacture or production of a product or to enhance unreasonably the price thereof,
>
> (c) to prevent or lessen, unduly, competition in the production, manufacture, purchase, barter, sale, storage, rental, transportation or supply of a product, or in the price of insurance on persons or property, or
>
> (d) to otherwise restrain or injure competition unduly,
>
> is guilty of an indictable offence and liable to imprisonment for a term not exceeding five years or to a fine not exceeding ten million dollars or to both.

Section 45(2) is intended to clarify the concept of undueness by not requiring that complete elimination of competition in the relevant market was the result of the agreement or the object of the parties:

> (2) For greater certainty, in establishing that a conspiracy, combination, agreement or arrangement is in contravention of subsection (1), it shall not be necessary to prove that the conspiracy, combination, agreement or arrangement, if carried into effect, would or would be likely to eliminate, completely or virtually, competition in the market to which it relates or that it was the object of any or all of the parties thereto to eliminate, completely or virtually, competition in that market.

Introduced with the 1986 revision, sections 45(2.1) and 45(2.2) are intended to prevent judicial interpretation of the offence as requiring proof of communication among the parties to prove the existence of an agreement, and requiring proof that the parties specifically intended that the agreement would lessen competition unduly:

> (2.1) In a prosecution under subsection (1), the court may infer the existence of a conspiracy, combination, agreement or arrangement from circumstantial evidence, with or without direct evidence of communication between or among the alleged parties thereto, but, for greater certainty, the conspiracy, combination, agreement or arrangement must be proved beyond a reasonable doubt.
>
> (2.2) For greater certainty, in establishing that a conspiracy, combination, agreement or arrangement is in contravention of subsection (1), it is necessary to prove that the parties thereto intended to and did enter into the conspiracy, combination, agreement or arrangement, but it is not necessary to prove that the parties intended that the conspiracy, combination, agreement or arrangement have an effect set out in subsection (1).

The offence does not apply to arrangements that relate only to the following, unless there is proof that the agreements actually lessen competition in respect to prices, quantity or quality of production, markets or customers, or channel or methods of distribution:

(a) the exchange of statistics;

(b) the defining of product standards;

(c) the exchange of credit information;

(d) the definition of terminology used in a trade, industry or profession;

(e) cooperation in research and development;

(f) the restriction of advertising or promotion, other than a discriminatory restriction directed against a member of the mass media;

(g) the sizes or shapes of the containers in which an article is packaged;

(h) the adoption of the metric system of weights and measures; or

(i) measures to protect the environment.

Export agreements are also exempted unless they result in a reduction in the real value of exports of a product; restricted entry or expansion in an export business; or undue restriction of competition in the supply of services facilitating Canadian exports.

In my view, the conspiracy prohibition applies now to regulated passenger transportation services to the same extent that it would apply if the applicable regulatory structures were removed. Note, however, that the application of the conspiracy provisions is limited in relation to the Crown and its agenda to the same extent as are all other provisions of the Act.

The conspiracy jurisprudence is extensive. Over the last decade, convictions or pre-conviction prohibition Orders (a substitute to a plea bargain specifically provided for by the Act) have generally been obtained when charges have been laid. The circumstances giving rise to charges generally have involved an actual or constructive agreement among all major suppliers in a market not to compete with respect to an important aspect of competition (price, product quality, product choice); or some disciplinary mechanism applied by wayward incumbents to innovative new entrants (for example, withdrawal or refusal of a group service needed to function as an effective competitor).

### 2. Prohibition Agreements

Important prohibition agreements with respect to the used household goods moving industry and the Western Canada for-hire trucking industry have effectively eliminated the use of tariff bureaux as a cartelizing mechanism and have introduced price competition for the first time in these sectors. These prohibition agreements have been influential in re-orienting the Bureau's conspiracy law enforcement policy. Instead of seeking convictions and large fines, the Bureau is leaning towards obtaining assurances that affirmative steps would be taken more quickly by the accused to open up the market and, to a degree, offset some of the negative affects of the agreements.

The used household goods prohibition Order, entered into in December 1983, requires the winding up of the Canadian Household Goods Carriers' Tariff Bureau and prohibits several restrictive practices by van lines including:

- rate fixing;
- adoption of fighting brands (that is, lower priced products targeted on a competitor's customers);
- using cost studies to coordinate rates;
- standardizing or limiting products;
- coordinating van utilization or requiring that products be supplied to discipline competition;
- generally using a van line's market power as franchisor to discipline the competitive conduct of van line members or to coordinate competition among van line members.

Periodic compliance reports were required to be filed with the Bureau and the court.

The Western trucking prohibition Order was entered into in April 1988. The inquiry on which charges were based commenced in the 1960s. The accused trucking companies (18 in all) and the Western Transportation Association (WTA) were prohibited from agreeing with any other motor carrier to:

(a) fix or coordinate single line rates in the market;

(b) enforce adherence to single line rates in the market as published by the WTA or any other motor carrier tariff bureau or motor carrier industry association;

(c) develop, adopt or use any policy, plan or program to respond to any motor carrier operating in the market;

(d) attempt, directly or indirectly, by threat, promise or any like means, to influence upward or to discourage the reduction of, the price at which any other motor carrier supplies or offers to supply single line services in the market; or

(e) restrict or impede in any manner the entry of any motor carrier competitor or potential motor carrier competitor in the market.

The trucking companies were also prohibited from using the Western Transportation Association or any other industry association, to signal adoption of single line rates unless notice was given to the public by other means.

The WTA and its officers and employees were prohibited from:

(a) initiating tariff rate proposals, docketing their own tariff rate proposals or making any recommendations whether to adopt, reject or otherwise dispose of tariff rate proposals before the WTA applicable to the market;

(b) initiating or developing any collective response among the members of the WTA to rates proposed or changed by any motor carrier operating in the market.

However, the Order does not extend to agreements on interline rates.

Taken together, the prohibition Orders set out with some certainty the types of tariff-bureaux conduct and rate arrangements in the transportation sector that the Bureau will likely challenge.

### 3. Constitutionality

The effectiveness of the conspiracy prohibition has recently been seriously called into question by a September 1990 decision of the Nova Scotia Supreme Court which found the prohibition, as drafted, in violation of the *Canadian Charter of Rights and Freedoms* and of no force as a consequence.

The case arose from charges brought in Nova Scotia against 12 pharmaceutical firms. The charges alleged that the firms had illegally conspired between January 1974 and June 1986 to lessen competition in the sale and provision of prescription drugs and dispensing services. The accused brought a motion to have section 45 ruled invalid as being contrary to sections 7, 11(a) and 11(d) of the *Canadian Charter of Rights and Freedoms.*

The first argument of the accused was that the *mens rea* (subjective intent) required to obtain a conviction violated section 7 (the right to life, liberty and security of the person deniable only in accordance with the principles of fundamental justice) and section 11(d) (presumption of innocence of an accused until proven guilty at a fair public hearing).

The Court found that the *actus reus* of the offence contained two elements:

(a) an agreement to which an accused was party; and

(b) the agreement, if implemented, would have the effect of limiting competition unduly.

The Court concluded that, in restricting proof of *mens rea* only to the first element, the provision violated sections 7 and 11(d) of the Charter.

The accused also contended that the undueness element of the offence was so vague as to deny their section 11(a) and (d) rights to a full answer and defence, and a fair trial. The Court agreed, stating:

> As indicated in Reference Re s.193, supra, the test, for determining whether or not a law is vague, as stated by Chief Justice Dickson and quoted earlier, is whether a person is capable of knowing, in advance, with a high degree of certainty, what conduct is prohibited and what is not. In my opinion, the virtual monopoly definition, of Mr. Justice Cartwright, provided some degree of certainty, but Parliament has eliminated that definition. The Crown says it is a question of degree, and that evidence of lessening competition was so extensive that it would be shown to be undue, but this does not answer the "knowing in advance" portion of the Reference Re s.193 test.

Having so found, it was easy for the Court to conclude that it would not be possible for the Crown to provide sufficient information in an indictment to ensure a fair and full trial.

The Court also addressed whether section 1 of the Charter could sustain these provisions, notwithstanding the violations of guaranteed rights. Section 1 states:

> The *Canadian Charter of Rights and Freedoms* guarantees the rights and freedoms set out in it subject only to such reasonable limits prescribed by law as can be demonstrably justified in a free and democratic society.

In reviewing the cases considering section 1, the Nova Scotia Court quoted, in particular, from a decision of Mr. Justice Graham of the Ontario Court of Appeal in *R. v. Seaboyer* (1987), 20 O.A.C. 345 (O.A.C.) where he stated:

> I think it would be a most unusual result that a law which offends s. 7 in that it deprives an accused person of making full answer and defence could ever be found "to be demonstrably justified in a free and democratic society."

In conclusion, the Court stated: "This is not one of the rare or exceptional cases such as a war or an epidemic where a s. 7 violation can be justified under section 1. Nor is the vagueness and uncertainty, contained in this section, a limitation prescribed by law."

Having come to these conclusions, the Nova Scotia Court then struck down the present sections 45(1)(c) and 46 as being contrary to the Charter. The Court also quashed the indictment in its entirety even though it dealt with events which took place before the passage of the Charter in 1982.

The Crown is appealing the decision. The Bureau has taken the position, as it normally does in such constitutional disputes, that the conspiracy law will continue to be applied in all other provinces until this case is determined. However, the Bureau's position may have to change if the Nova Scotia Court of Appeal upholds the decision or if a federal court in a different case reaches the same conclusion.

This decision again highlights the difficult constitutional underpinnings of federal competition law under the current constitutional structure and will certainly cause a reconsideration of structuring key elements of the law as criminal offences. It is worth noting that federal government proposals for competition law reform dating from the mid-1970s favoured the shift of all criminal matters, including conspiracy, to a civil law context to be adjudicated by an expert tribunal.

The case will undoubtedly be resolved by the Supreme Court of Canada. This will probably take at least two years.

This decision was a shock to what was thought to be the firmest foundation of Canadian competition law and will likely test the commitment of the federal government to a federal competition law.

## D. MERGERS

### 1. Brief History

The 1986 revisions to the *Competition Act* included a dramatic change to the general merger law, replacing a clearly ineffective criminal prohibition with a complex standard for merger review by the Competition Tribunal.

However, since the new merger regime took effect four years ago, only one contested merger (that of Reservec/Gemini) has reached the trial stage and two others have been the subject of yet-to-be adjudicated applications (Quebec meat renderers and British Columbia south mainland newspapers). A much larger number of mergers challenged by the Bureau have resulted in agreement between the merging parties and the DIR to restructure the merger to remove the aspect of the transaction that would have caused a substantial lessening of competition in the relevant markets. In consideration of this, the DIR did not make application to the Tribunal.

Typically, these agreements have involved the divestiture of certain assets or product lines to third parties to increase overall competition in the industry and to reduce market power in the most concentrated submarkets supplied by the merging parties.

To date, only horizontal mergers have been challenged. A general rule has developed over the first three years of enforcement. A merger would be challenged if it involved two of the three largest suppliers in a market and resulted in the merged company having a market share above 50 percent with no comparable competitive market share.

More frequently, the DIR has submitted a consent arrangement for Tribunal approval. In two cases, *DIR v. Palm Dairies Ltd.* (1986), 12 C.P.R. (3d) 540 (Comp. Trib) and *DIR v. Imperial Oil Ltd.* (unreported Comp. Trib. decision, February 6, 1990, CT-89-3), the Tribunal exercised its independence and rejected the original proposals on the basis that they did not sufficiently correct the lessening of competition caused by the merger.

Since the new merger law had generated very limited true jurisprudence, particularly with respect to what constitutes a substantial lessening of competition, in November 1990, the Bureau published proposed merger guidelines to increase the predictability of the law. These guidelines were finalized in March 1991. They are discussed briefly below. Rather than providing a general survey of all merger resolutions, the following section reviews the Director's approach to the PWA/Wardair merger and the resolution of the Reservec/Gemini CRS merger case.

### 2. Merger Law

The Act defines a merger broadly as the acquisition or establishment, direct or indirect, by one or more persons, whether by purchase or lease of shares or assets, by amalgamation or by combination or otherwise, of control over or of significant interest in the whole or part of a business of a competitor, supplier, customer or other person (section 91).

The Bureau considers a "significant interest" to be less than a controlling position but entailing the actual or potential ability to influence materially the firm's economic behaviour.

A reviewable merger is an actual or proposed merger which prevents or lessens, or is likely to prevent or lessen competition substantially in a market (section 92(1)).

The Tribunal may not make a finding of substantial lessening of competition solely on the basis of evidence of concentration or market share (section 92(2)).

The Act provides a non-exhaustive discretionary list of factors for assessing the impact on competition:

(a) the extent to which foreign products or foreign competitors provide or are likely to provide effective competition to the businesses of the parties to the merger or proposed merger;

(b) whether the business, or a part of the business, of a party to the merger or proposed merger has failed or is likely to fail;

(c) the extent to which acceptable substitutes for products supplied by the parties to the merger or proposed merger are or are likely to be available;

(d) any barriers to entry into a market, including:

  (i) tariff and non-tariff barriers to international trade,

  (ii) interprovincial barriers to trade, and

  (iii) regulatory control over entry,

and any effect of the merger or proposed merger on such barriers;

(e) the extent to which effective competition remains or would remain in a market that is or would be affected by the merger or proposed merger;

(f) any likelihood that the merger or proposed merger will or would result in the removal of a vigorous and effective competitor;

(g) the nature and extent of change and innovation in a relevant market; and

(h) any other factor that is relevant to competition in a market that is or would be affected by the merger or proposed merger.

The Tribunal may not issue a remedial Order if it finds that the merger is likely to bring about efficiency gains that will be greater than, and offset, the effect of any lessening of competition and these efficiency gains would not likely be attained if the remedial Order were made (section 96).

Finally, certain joint ventures of limited duration that meet conditions set out in the Act are also exempted (section 95).

The merger guidelines emphasize that the primary focus in determining an effect on competition is the ability to exercise a greater degree of market power, with the price dimension of competition being the dominant concern. Relevant price increases may either be unilateral or the result of "interdependent behaviour." That is, the possibility that the merger might result in collusion or even conscious parallelism would be taken into account. This concern over an enhanced ability to collude has been supported in both the Reservec/Gemini and Imperial Oil/Texaco cases.

The guidelines provide that a substantial effect on prices would be one that is materially greater over a substantial part of the effective market and that new or increased competition would not likely be eradicated within two years.

### 3. Market Definition

Definition of the relevant market is critical in merger assessment. The draft guidelines provide, after an extensive discussion, the following conceptual definition: . . . a relevant market is defined as the smallest group of products in the smallest geographic area in relation to which sellers could impose and maintain a significant and non-transitory price increase above the level that would likely exist in the absence of the merger. In most cases the Bureau considers a 5 percent increase to be significant, and a one year period to be non-transitory.[3]

This hypothesis will certainly be hard to apply. Consequently, the merger guidelines present a lengthy list of more subjective market definition criteria:

(a) the views and behaviour of buyers of the product;

(b) the views of other competitors in the same business;

(c) the functional substitutability of products in the market;

(d) the physical and technical characteristics of the product;

(e) the costs a buyer would incur in switching to a different product;

(f) price relationships or relative price levels between two products;

(g) cost of adapting or constructing facilities to sell the product; and

(h) whether there exists a second-hand, reconditioned or leased product market.

With respect to geographic market definition, the evaluation criteria set out in the guidelines are:

(a) the views of buyers in the marketplace;

(b) the switching costs of moving from one producer's product to another;

(c) transportation costs as an impediment to sourcing product outside a defined area;

(d) any local setup costs for a new entrant;

(e) inherent characteristics of the product which could be relevant, such as perishability;

(f) review of price movements in different geographic areas and any evidence of correlation;

(g) the shipment patterns of the product in the past; and

(h) foreign competition.

### 4. Statutory Evaluation Criteria

The guidelines also address each of the statutory factors listed above. The objective is to suggest thresholds below which it is unlikely a merger would ever be challenged. For example, with respect to the critical concepts of market share and concentration, it is proposed that the merger would not be challenged where the post-merger market share was less than 35 percent, or where the post-merger market share of the four largest firms in the market was less that 65 percent and the market share of the merged firm was less than 10 percent.

Of the remaining factors, barriers to entry, effective competition remaining and failing firm are the most important.

If entry were to take place on a sufficient scale to ensure that a price increase could not be sustained for more than two years, the merger would not be challenged.

Where the pre-merger level of effective competition would remain, the merger would not be challenged.

The guidelines present a detailed discussion of what constitutes a failing-firm situation. To accept this as a ground for not challenging the merger, the Bureau would require identification of the time within which the firm might become insolvent, a reasonable search for a purchaser prepared to pay more than the firm's breakup value, and provision of detailed supporting financial information. The guidelines state that the Bureau needs about 60 days to determine whether a firm is indeed failing and may require a third party to find a buyer.

The guidelines also raise two new factors: market transparency and transaction value and frequency. With respect to market transparency, the guidelines state:

> . . . where a merger raises concerns that it may be likely to facilitate interdependent behaviour, the extent of transparency in the relevant market will ordinarily be assessed. Transparency in this context connotes information that is readily available in the market about competitors: prices; levels of service; innovation initiatives; product quality; product variety; level of advertising; etc.. In general, as the level of transparency in a market decreases, coordinated behaviour becomes increasingly difficult, because firms find it harder to detect and retaliate against secret discounts and other deviations from interdependent situations. (p. 42)

The guidelines also talk about schemes which increase transparency such as delivered pricing systems, product standardization, exchanges of information through trade associations, etc., public disclosure of information by buyers or government sources, and "meeting competition" contractual terms.

The second new factor — transaction value and frequency — is also related to mergers where independent behaviour may be a concern. It states:

> Interdependent behaviour often becomes increasingly difficult as the frequency and regularity of sales of the relevant product decrease, and as the value of each sale increases. (p. 43)

Although the guidelines do not state how important these two criteria are, they both relate to the interdependent behaviour or tacit collusion on which the DIR might challenge a merger.

### 5. Procedure

The guidelines indicate that the DIR should be able to make a preliminary determination within three weeks as to whether there is a serious question. If there is, the guidelines state:

> . . . a determination can be made of whether a merger prevents or lessens competition substantially within eight weeks after the parties have provided all requested information. This period of time is required in order to review this information, and to gather and review information provided by customer, suppliers, competitors, experts, others in the industry and government departments that have information pertaining to the market(s) in question. Where information is not provided upon request by merging parties or others, the Director may seek to exercise the formal powers provided under section 11, 15 or 16 of the Act. (p. 60)

The guidelines also indicate that where there is still a significant issue after this period, which presumably means that the DIR has concerns about the merger, the DIR can take up to a further four months to decide whether to refer the matter to the Tribunal.

### 6. PWA/Wardair Merger

The first merger clearance accompanied by a fairly detailed set of reasons related to the 1989 merger of PWA and Wardair.

After an investigation, the DIR announced on April 14, 1989 that he believed Wardair to be a failing firm and that, in those circumstances, the merger would be challenged only if a viable third party came forward and was willing to acquire Wardair. In the week that followed the Director's announcement, there were other expressions of interest in Wardair, including a possible joint offer between American Airlines, the large U.S. based carrier, and certain Canadian partners. Finally, however, no offer was forthcoming by any third party.

It is apparent from the background information provided by the DIR, that the acquisition raised serious concerns. The DIR viewed Wardair as a vigorous and effective competitor. The background information document states:

> Overall, in markets where it participated, Wardair was often the price leader, offering effective competition to the two established national carriers in all classes of service.[4]

The DIR also was concerned that the acquisition would threaten effective competition in the domestic airline service industry. The background document stated that most scheduled airline service in Canada would be provided by Air Canada and Canadian Airlines International Ltd. and that consumers would have little countervailing power to deal with such a "duopoly."

The DIR indicated there were other reasons to expect that the merger would lessen competition. In particular, he noted that the stock market reaction, which had led to higher stock prices for both Air Canada and PWA, was a sign that investors expected increased profits for the rivals of Wardair. Also, he cited statements by officials of Wardair and PWA that the merger would reduce capacity in the industry and restrict the availability of discounted seats.

The DIR was also concerned with barriers to entry to the domestic airline industry in the short to medium term. He indicated that:

> Recent economic analysis of the industry indicates that the industry reflects the presence of economies of scope which give scheduled carriers offering a range of fare types cost advantages over scheduled carriers offering one-fare, one-class service, and over chartered carriers that can offer only restricted fares with travel conditions on return dates and itinerary changes.[5]

The DIR referred to the preference of business travellers for an airline with an extensive network and frequent flights, the loyalty generated by frequent flyer programs, and the preference for good commuter connections made easier by the two largest carriers.

The DIR also cited the limited ability of Transport Canada to provide landing rights to new carriers at Pearson International Airport in Toronto. The DIR stated that:

> At Pearson International Airport, the most critical public resource at the moment is the take-off and landing times at peak hours. These are

> currently limited to 70 per hour. Accommodating new entrants at this juncture will be difficult. Nevertheless, Transport Canada has recently reaffirmed to the Bureau that every effort will be made to do so.[6]

As a final barrier to entry, the DIR mentioned the restrictions on foreign ownership which allow non-Canadians to hold a maximum 25 percent voting interest in a Canadian scheduled carrier. He also noted that cabotage rules prohibit foreign carriers from offering point-to-point scheduled service within Canada. The Canadian cabotage rule is similar to that in the United States.

Nevertheless, the question of the failing-firm factor under the merger law remained. The DIR noted that there were two significant issues to be assessed in considering the failing-firm issue: first was the extent to which the failure is, in fact, likely to occur and, secondly, whether there are alternatives to the merger that would be less restrictive of competition.

With respect to the first factor, the DIR stated:

> A firm that is facing certain and imminent financial failure will cease to exercise any competitive influence in the market after its failure. Therefore, the loss of this influence in the marketplace cannot be attributed to the merger.[7]

The accounting firm of Peat Marwick, retained by the DIR to review the financial evidence provided by Wardair, reviewed the options which might have prevented the failure of Wardair. These included deferring principal payments, loans on existing fixed assets, the sale of a minority interest and reversion to a chartered carrier status. The Director's background statement indicates that none of these are attainable or workable in the circumstances of Wardair.

With respect to alternatives, the DIR considered third-party buyers and also liquidation of the failing firm. The DIR concluded that the most likely result would be the withdrawal of Wardair's assets from the Canadian market. The background statement indicates:

> There now exists considerable excess capacity in the market and Wardair's A310 aircraft are not compatible with the fleets of other airlines in Canada.[8]

Having weighed all of these factors, the DIR concluded that the significance of the failing-firm factor outweighed the negative assessment of the other competition-based factors in the Act.

It is evident that the Director's decision was a difficult one. The effect on competition of the withdrawal of Wardair was immediate and palpable. Fares went up; fare choices declined.

The failure of Wardair raises serious questions more about the viability and effectiveness of airline deregulation in Canada in the context of remaining regulatory entry barriers effectively controlled by Transport Canada and less with respect to the effectiveness of the merger law.

These government-controlled entry barriers are principally:

(1) *the statutory foreign investment ceiling* of 25 percent which reduces the access of new and existing carriers to the capital market and severely reduces the effective market for control of larger existing carriers. In particular, this investment limit creates a significant disincentive to the transfer of technology and managerial skills from non-Canadian air carriers to Canadian air carriers;

(2) *landing and takeoff slot allocation practices* of airport management which "grandfather" incumbent allocations, effectively control new entry to airports through incumbent-dominated advisory committees, and do not ration supply on the basis of the marginal value of slots; and

(3) *limitation of foreign, and particularly U.S., air carrier access* to the Canadian market through treaty arrangements.

The Director's background statement identifies three reasons why deregulation may not have been as successful as expected when it was introduced in the early part of this decade. The first is the possibility that economies of scope are a significant barrier to entry into the scheduled airline business. When the United States and Canada deregulated airlines, the common view was that economies of scale were small in the industry and that economies of scope were not significant. Since then, it has become clear that economies of scope are much more important than previously thought. Secondly, restrictions on foreign ownership and foreign operations in Canada give the federal government the means to inject competition in the domestic market if it wishes to do so. Whether Transport Canada will relax these requirements, however, remains to be seen. Finally, the analysis points to a third factor, access to hub airports. Since this is controlled by committees made up of incumbent carriers and Transport Canada officials, it is also seen as a serious barrier to entry.

The National Transportation Agency found that the Wardair acquisition by PWA was not against the public interest. Its decision was based largely on the financial health of Wardair, as was the Director's decision. Indicating that it was in no way interfering with the DIR's review, the NTA stated that the purpose of its review was different from that being conducted by the DIR under the *Competition Act*. This is apparently the first time the NTA has explicitly recognized the separate jurisdiction of the DIR to review the same merger transaction.

### 7. Reservec/Gemini Merger

On March 3, 1988, the DIR applied to the Competition Tribunal for an Order ordering Air Canada (AC) and Canadian Airlines International Limited (CAIL) to dissolve their limited partnership instituted to combine the operations of the Reservec and Pegasus Computer Reservations Systems into a single system known as Gemini.

Computer Reservations Systems (CRSs) are an increasingly important element in the distribution and sale of airline passenger seats to travel agents and to the travelling public. The systems distribute information on schedules, fares, rules and seat availability to subscribers (usually travel agents) for the airlines which are hosted on, or participate in, the system. This information is distributed electronically through a Computer Reservation Terminal (CRT) which is sold or leased to the subscriber and is located on the subscriber's premises.

The Director's application stated that before the merger, Air Canada's Reservec distributed information to approximately 2,900 travel agencies on behalf of 50 airlines, railways and car rental agencies, 3,000 hotels and 16 tour wholesalers. The application indicated that Reservec was the dominant CRS in Canada, holding about 72 percent of the CRS market as measured by travel agent locations.

Pegasus was developed by Canadian Pacific Airlines before its 1987 merger with PWA. Pegasus entered the Canadian market in 1984 and, according to the Director's application, "introduced some innovative features, providing competition for Reservec." The application claimed that between 1984 and 1987, Pegasus established its system in approximately 720 travel agencies providing information on and to 60 airlines, 14 car rental agencies, 3,000 hotels and tour wholesalers. The application stated that Pegasus was the second largest CRS in Canada, holding approximately 18 percent of the CRS market as measured by travel agent locations.

On June 1, 1987, AC and CAIL (the airline resulting from the CP/PWA merger) took steps to merge the Reservec and Pegasus systems through a limited partnership in which each of the parties received partnership units and other consideration reflecting the proportion of assets contributed to the partnership.

The DIR submitted that there are no effective substitutes to a CRS and that prior to the merger there were three other competitors to Reservec and Pegasus, including Sabre, a subsidiary of AMR Corporation which also owns American Airlines. Sabre had entered the Canadian market in 1983 and, by June 1987, had approximately 10% of the market as measured by travel agent locations. The other two competitors noted are Apollo, a CRS operated by Covia Corporation which is owned by United Airlines, and Soda/System One, owned by Texas Air Corporation. The application claimed that the latter two CRSs have an extremely small presence in the market with a combined market of less than 1%. To establish the importance of CRSs in the supply of airline tickets, the application noted that travel agencies are now the primary means for airlines to distribute their product to the travelling public. Approximately 70% of the tickets sold by Canadian airlines are sold through travel agents and approximately 90% of all Canadian travel agencies use CRSs to make airline reservations and to print tickets. The other 30% of the tickets are sold by the airlines directly to the travelling public. In almost all cases, the application claimed, the airlines use CRSs to assist with sales.

Critical to the Director's theory of the case was the distinction between the CRS services available to a "hosted carrier," and the lesser grade of CRS services available to a "participating carrier." If a carrier is hosted, the CRS stores the carriers complete inventory information. In this case, the CRS provides the carrier with both an internal reservation and management system to manage its inventory and an external reservation system to distribute its product to travel agents and consumers. Air Canada and Canadian Airlines International are now hosted with the Gemini system.

If an airline is a participating carrier, the CRS does not supply an internal reservation and management system but instead only lists the information on fares, schedules and seat availability which the participating carrier supplies. A participating carrier may choose not to supply all of its inventory so that certain classes of seats may not be displayed on the CRS in which the airline is participating.

The application alleged that a hosted carrier has a significant competitive advantage over participating carriers because of the completeness, accuracy and timeliness of information on seat availability from the CRS with respect to hosted carriers.

The application also stated that, for practical purposes, an airline can store its entire inventory in only one place, which means that it can participate in a number of CRS systems but can be hosted by only one. Many of the advantages of hosted carrier status, however, can be obtained by means of a direct access data link between the CRS and the data base of the participating airline. The application noted that there are several CRS vendors in the United States, all of which have a direct access link with carriers who are hosted in another CRS:

> These links mean that these CRS vendors compete on the basis of what their systems can do and the price at which they do it rather than on the basis of exclusive control of airline inventory. In Canada, prior to October 31, 1987 there were no direct access links between the three largest CRS vendors in Canada namely Reservec, Pegasus and Sabre. On or about October 31, 1987 an electronic direct access link was established between Reservec and Pegasus, giving users of either Reservec or Pegasus last seat availability on Air Canada and Canadian Airlines International.

Last Seat Availability refers to the capacity of the CRS to call up for reservation seats held back by the airline from CRS booking of the airline. It is regarded by travel agents as an important competitive feature.

The principal grounds presented by the DIR in his application were:

- *Increased concentration:* Gemini's post-merger market share is calculated at 90 percent (of travel agent locations versus 10 percent for Sabre) and "has reduced the number of significant CRS competitors in Canada from three to two and in many non-urban areas has eliminated competition completely."
- *Increased barriers to entry:* The application contended that the superior service delivered by Gemini for AC and CAIL and their affiliated and aligned carriers, coupled with the current dominant position of these two carriers in the Canadian market, provides Gemini and its owners with the ability to block or frustrate the entry of competing CRSs by reducing the access of competing systems to timely and reliable information on the operations of AC and CAIL. The application also claimed the possibility of new entry into the CRS by a non-airline vendor is remote because of the substantial software and hardware development costs and the fact that airline vendors enjoy significant economies of scope because they must have a reservation system in any event.
- *Lack of availability of substitutes:* The application claimed that other sources of information such as manual reference to the *Official Airline Guide* and the use of the telephone to make airline reservations are too time consuming to be a practical alternative for most travel agents.
- *Effective competition remaining and removal of a competitor:* The application stated that the merger would reduce the effectiveness of Sabre as a competitor because Sabre, in the absence of a direct access link with Air Canada, CAIL and Gemini, would not be able to provide its travel agent subscribers with Last Seat Availability and other enhancements on AC and CAIL flights available through Gemini. The application also alleged that Sabre could be quickly neutralized by AC and CAIL if they exercised the market power they hold by reason of their dominant position in the airline market. For example, the application suggested that withdrawal of their participation in Sabre "would likely force Sabre to withdraw from the Canadian market because Sabre would then be providing a service without any booking fee revenues."
- *Impact on airline industry competition:* The application also alleged that the merger wou[illegible]y entrench the dominant position of AC and CAIL in the airline industry at the expense of Wardair and potential new entrants in both the jet carrier and turbo-prop markets in Canada; it would also be

a detriment to U.S. and international carriers who compete in transport or international markets with AC and CAIL. In this regard, the application suggested that competing carriers which host or participate with Gemini may be subject to bias and other disadvantages which could severely inhibit their ability to compete. The suggested disadvantages include denial of access to the CRS, inaccurate loading of information, biased flight display ordering, and discriminatory booking fees. However, it should be noted that the application did not allege that any such practices have in fact taken place in Canada. The application essentially suggests that such activities would be more likely were the merger to take place.

The application therefore presented a number of important issues:

- To what extent should concentration in one market in transport be used in assessing the impacts of a merger in the production of a complementary product (CRS), and conversely what weight should the Tribunal attach to the possible lessening of competition in air transport that may result from the CRS merger?
- Is dissolution of the merger the only appropriate remedy? Could the possible anti-competitive impacts of the merger be sufficiently reduced if Air Canada's and CAIL's competitors were provided with direct access data links with those carriers' reservation systems as is done in the U.S.? To what extent is the viability of this option affected by the more concentrated nature of the Canadian air transport industry compared to the U.S. industry?
- What weight, if any, should be given to any increased potential for the abuse of dominant position in the market of the merger or related markets in determining whether the merger substantially lessens competition?
- Does the merger entail efficiency gains which are not likely to arise if the merger were dissolved and which, therefore, may exempt it from a remedial Order notwithstanding that it may lessen competition?

*(a) Air Canada and CAIL Responses*

The written responses of Air Canada and CAIL followed similar lines and disputed the Director's application in the following principal areas:

- market definition;

- efficiency gains and competitiveness in the CRS business; and
- impact on competition in the air transport business.

With respect to market definition, the respondents contended that in certain respects the appropriate market for CRS and airline services should include the domestic, transborder and international markets. In such a market, Gemini remains a minor player relative to Sabre, the dominant CRS in North America, and the principal remaining CRS competitor in Canada. The respondents also contended that measurement of market share according to travel agencies served (as was done in the Director's application) is not appropriate and leads to an overstatement of Gemini's share. Booked flight segments was proposed as the appropriate proxy for CRS revenues.

Several efficiency-related arguments were presented:

- The merger resulted in cost savings of $15 million a year flowing from economies of scale (reduced facilities and operational duplication).
- The world market could sustain only a few CRS firms due to the requirement for large-scale technology and the inherent cost advantages of an airline-sponsored CRS. A minimum efficient firm size or "critical mass" for the North American and Canadian markets is at least that of Gemini, if not larger, and only CRSs sponsored by major airlines are likely to survive over the long term. Air Canada and CAIL, therefore, contended that the merger increased the competitiveness of Gemini against rivals such as Sabre which had already reached an efficient size and could enter the Canadian market. Thus the market could support only one indigenous CRS. Dissolution of the merger would therefore result in two inefficient Canadian CRS suppliers.
- Pegasus was a non-starter. It could not achieve an efficient scale on its own and, due to poor product design and Reservec's previously established position in the Canadian market, Pegasus could capture only low-volume, non-urban travel agencies.
- The economies of scale realized from the merger would allow the Canadian CRS system to invest in new technology and to provide high-quality service to smaller Canadian centres.
- Air Canada's and CAIL's desire to increase market share against North American rivals would keep Gemini CRS booking fees low for travel agents.

With respect to the impact on competition in the airline business the respondents stated that:

- the merger increased the ability of Air Canada and CAIL to negotiate improved reciprocal access to the North American CRSs, thus enhancing their overall access to the North American and international market; and
- CAIL benefitted from obtaining some of the "halo effect" Reservec formerly provided exclusively to Air Canada.

On the related issue of the merger facilitating future abuse of dominant position in both CRS and air travel, the respondents argued that:

- Reservec used to have 100 percent of the Canadian market but no anti-competitive conduct was detected by a federal task force, unlike the findings of the 1984 Civil Aeronautics Board with respect to the airline display practices of some U.S. systems;
- both Air Canada and CAIL were formally committed in writing to the Minister of Transport to allow fair access to Canadian CRSs;
- Gemini was operated autonomously from the airlines; and
- the DIR could make an abuse of dominance application at any time when the facts support it.

The Director's application considered at some length Gemini's provision of Last Seat Availability (LSA) only to Air Canada and CAIL and argued that this practice would lessen competition among Canadian airlines by creating an incentive to agents to rely on Air Canada's and CAIL's service exclusively. The respondents, however, contended that LSA had been overrated as an impediment to fair competition since travel agents could obtain the last seats directly from the airline in any event. They also contended that LSA provides an important commercial advantage in competing for travel agency clients with the "functionally superior" U.S. based Sabre system.

*(b) Director's Reply*

The Director's reply presented the following principal arguments:

*(i) Market definition:* Canada is the appropriate geographic market. CRS operations are geared to the principal business incentives of their airline

parents. U.S. CRSs, therefore, lack the same incentives as Gemini to provide service in Canada since their airlines cannot serve the entire Canadian market.

*(ii) Critical mass/economies of scale:* The respondents had presented no empirical evidence on the minimum efficient size for a CRS firm and no evidence that the Canadian market could support only one indigenous firm. Reservec was profitable before the merger with 2,900 travel agency subscribers.

*(iii) Pegasus as a Failing Firm:* Pegasus should be expected to lose money in its start-up years but by the time of the merger Pegasus had achieved 72 percent of the 1,000 travel agency subscribers originally forecast as required for break-even.

*(iv) Remaining effective competition:* Sabre's competitiveness in the Canadian market was entirely dependent on Gemini not exercising its market power by Gemini's refusal to provide direct access to airlines competing with Air Canada and CAIL.

*(v) Abuse of dominance:* Political assurances of fairness were insufficient protection to competitors. Wardair and other domestic competitors had no domestic CRS alternative as the result of the merger. Gemini had a near monopoly in some local CRS markets.

### *(c) Further developments*

During the pre-hearing stages of the case it was announced (September 28, 1988) that the Gemini Group and the PARS reservation system based in the U.S. would become partners in a new CRS. This partnership would be the largest multi-hosted CRS in the world comprising the 3,500 Gemini and 6,300 PARS travel agency locations. The owner of PARS are Northwest Airlines and TransWorld Airlines.

On December 7, 1988, the DIR filed an amended application requesting the Competition Tribunal to order Air Canada and Canadian Airlines International Limited (CAIL) not to proceed with the PARS merger or, if that merger was complete, to order its dissolution.

The Director's application contended that the PARS merger, in addition to the Gemini merger, enabled Gemini and its airline owners to sell a share of their near monopoly in CRS in Canada to another company in exchange for the PARS CRS technology without diluting the market power that flows from the Gemini merger. The DIR contended that the PARS merger would not reduce either the incentive or the ability of Gemini to exercise that market power to prevent or lessen competition in Canada. Further, the DIR alleged that the PARS merger made it even more likely that Gemini would maintain or increase its "overwhelming market dominance" as follows:

> As long as Air Canada and CAIL refuse to allow direct access links to other CRS systems from their completed inventorial schedule, fare rules, seat classes and seat availability, the enhanced functionality of PARS over Gemini makes it even more unlikely that any other CRS will be able to effectively compete in Canada. . . .
>
> The PARS merger will also eliminate additional possibilities for enhanced CRS competition and entry in Canada. PARS could have sold its CRS software to either Reservec or Pegasus; become an independent entrant in Canada; or more likely become a joint venture partner with one of the Gemini airline owners with the other free to operate independently or join with one of the other major U.S. or European CRS's as a second major CRS competitor in Canada.

The DIR also alleged that the PARS merger supported his position that the Gemini merger was not necessary to obtain state-of-the-art CRS technology for Canada. Such technology would appear to be readily available in the U.S. and elsewhere, and Air Canada or CAIL individually could acquire such technology by a joint venture or by hardware or software purchases from a number of CRS vendors. Consequently, the DIR stated that Gemini did not need a "near monopoly" in Canada in order to build a "made in Canada" CRS and that indeed with the PARS merger it had chosen not to do so.

With respect to the impact of the PARS merger on competition in the airline industry, the DIR contended that Air Canada and CAIL would continue to have the incentive and ability to prevent or lessen competition in airline markets and that the PARS merger did not alter this at all. In addition, the DIR contended that the remaining partners in PARS, TWA and Northwest Airlines, would have no incentive to stop this lessening of competition within Canada because they did not serve domestic Canadian city pairs and would not be adversely affected by any reduction in domestic airline competition. The DIR also noted that the U.S. Civil Aeronautics Board rules, requiring non-discriminatory CRS access, were not applied to the operation of PARS in Canada. As a result, PARS would be able to engage in CRS abuses in Canada without being subject to any CRS rules or regulations.

Finally, the Director's application contended that the current PARS data display was ordered in such a way that interlined connections were penalized and given a lower priority in the display as compared to on-line connections. No interline "penalty" would be imposed on connections between Air Canada/CAIL and their respective affiliates. The DIR contended that the inability of interlined carriers, such as Wardair, to have their flights and fares displayed without the substantial "penalty" imposed through the PARS merger prevented such carriers from competing with the two dominant Canadian carriers, Air Canada and CAIL. The application contended that the PARS "penalty" against interlined connections heightens the barrier to entry into Canadian city-pair markets by increasing the control of Air Canada and CAIL over feed traffic.

### *(d) Resolution*

The Tribunal's hearing on the Director's expanded application was to have commenced on April 3, 1989. The Tribunal was critical of this long delay to trial and largely placed the blame on the tactics of legal counsel on both sides. On that date, the DIR advised the Tribunal that agreement had been reached with the respondents and that he would be seeking the Tribunal's approval of the consent.

The proposal in essence allowed the Gemini merger to remain intact but required Gemini to provide data links to competing CRSs. Following a hearing on the proposed Order, at which a competitor/intervener, American Airlines, provided both expert and factual evidence, the Tribunal, at a post-hearing conference indicated changes it would require to approve the Order.

The principal elements of the Order approved by the Tribunal on July 7, 1989 were:

(1) Air Canada and CAIL must provide any other CRS operating in Canada with the same advance seat selection and boarding pass capability which they have provided to Gemini, if that other CRS offers reciprocity;

(2) Gemini must make available to travel agents any and all enhancements made available to Gemini by participating carriers;

(3) Gemini must provide direct access links to provide Last Seat Availability on Air Canada and CAIL, providing both "look but not book" and "look and book" features, subject to specified terms, implementation dates, and prices for certain existing competing CRS;

(4) Booking fees must be non-discriminatory; and

(5) The respondents would prepare a set of CRS rules affecting information display, contracts with participating carriers and subscribers (to prevent discrimination, tying or other exclusionary practices), access to airline information service enhancements, marketing information, ticketing and enforcement.

The reasons for its approval of the Order amplify the Tribunal's approach to exercising its discretion to approve such orders. The key elements are:

(1) The role of the Tribunal is not to ask whether the consent Order is the optimum solution to the anti-competitive effects which are assumed to arise from a merger;

(2) The Tribunal's role is to determine whether the consent Order meets a minimum test. The test is whether a merger, as conditioned by the terms of the consent Order, results in a situation where the substantial lessening of competition, which it is presumed will arise from the merger, has, in all likelihood, been eliminated; and

(3) If the terms of an Order are vague and therefore cannot be enforced by way of contempt proceedings, or if the terms imposed are virtually impossible to monitor, then the Order cannot meet the test of effectiveness necessary to eliminate the substantial lessening of competition which is required of it.

In this context it would be worth setting out the concluding remarks of the Tribunal:

> The determination of whether or not a given situation will result in a substantial lessening of competition is a speculative decision. An order such as that which the Tribunal is asked to issue is a web of

interrelated provisions. Counsel for the Director referred to it as a delicate balance of trade-offs. There is no doubt that there is more than one combination of terms and conditions which could achieve the result which it is hoped the terms and conditions which are now before the Tribunal will achieve.

There have been significant modifications made to the consent order in response to concerns raised during the course of the hearing of this application and in response to suggestions made by the Tribunal. A comparison of the consent order filed on April 13, 1989 and that filed on June 2, 1989 demonstrates this.

As noted above, the Tribunal has expressed concerns that have not been met. It may very well be that had the Tribunal crafted the order itself a set of conditions would have resulted different from those which the Director and the respondents have agreed upon. There is no doubt that if some of the provisions proposed by American Airlines had been adopted into the consent order a more rigorous instrument for creating a post-merger competitive environment would have been created. But, as has already been said, the Tribunal does not consider that it has been given a mandate to craft the best possible terms and conditions for protecting competition. Its role is limited to vetting the order before it to ensure that the proposed terms and conditions are likely to be effective in eliminating any adverse effects of the merger.

It is of considerable significance that almost all of the intervenors support the consent order, including American Airlines. It is of significance that there has been little evidence adduced that the merger as conditioned by the consent order will lead or will likely lead to a substantial lessening of competition. In addition, the Tribunal notes that the general trend is toward the formation of large, jointly-owned CRSs. It is clear that the implementation of some of the terms of the consent order will require the diligent and continual surveillance of the Director. It is clear that changed conditions or effective enforcement of the order may require a return to the Tribunal for either changes to or interpretations of the order. Taking all these considerations into account, the Tribunal concluded, on the basis of the evidence before it, that the consent order meets the test required by the legislation.[9]

## E. ABUSE OF DOMINANT POSITION

### 1. Introduction

The 1986 revision established a new reviewable practice, abuse of dominant position, to replace the ineffective and unused criminal prohibition against creation or operation of a monopoly against the public interest.

Abuse of dominant position is broadly drafted, and could become potentially sweeping in scope, depending upon the priorities and creativity of the DIR and the initial jurisprudence of the Tribunal.

As discussed above, it is at least likely that abuse of dominant position will take the place of the predatory pricing offence as the means of reviewing and controlling unilateral anti-competitive pricing behaviour.

Unfortunately, it is not easy at this point to anticipate the likely scope or effectiveness of this reviewable practice. In the one decided case (NutraSweet discussed below) the Tribunal also granted substantially all the relief sought by the DIR through finding the existence of "lesser" reviewable practices (tied selling and exclusive dealing). There have been no enforcement guidelines published.

Abuse of dominant position is, however, modelled upon article 86 of the *Treaty of Rome* which established the general competition policy for intra-Community trade, and there is a considerable and growing body of European Community jurisprudence on the practice. In fact, the NutraSweet monopoly over aspartame was challenged under the *Treaty of Rome* prior to the DIR applying for a similar remedy in Canada.

For example, the market control concept of the *Treaty of Rome* relates to a position of economic strength which allows an undertaking to prevent effective competition being maintained in the relevant market. Such a position enables the company to behave to an appreciable extent independently of its competitors and customers, and the ultimate consumer. At first, this approach appears to be broader than the concept of market control advanced in North American anti-trust literature which (see the proposed merger guidelines) concentrates on the capacity to sustain price increases for a non-transitory period. In Europe, dominance has been found where the supplier's overall market share was less than 50 percent but it had a much higher specific share by virtue of its brand recognition in certain product lines.

### 2. Statutory Provisions

Section 79 of the *Competition Act* authorizes the Tribunal to issue an Order prohibiting all or any respondents in a DIR's application from engaging in a practice of anti-competitive acts where:

(1) the respondent(s) substantially or completely control a class or species of business throughout Canada or in any area of the country;

(2) the respondent(s) have engaged in or are engaging in a practice of anti-competitive acts; and

(3) the practice is having, has had, or is likely to have the effect of preventing or lessening competition substantially in a market.

If a remedial prohibition Order is insufficient to restore competition, the Tribunal has the jurisdiction to order divestitures of asset or shares sufficient to overcome the practice's effects.

In making its impact assessment, the Tribunal must address whether the practice is a result of superior competitive performance.

Section 78 of the Act is a non-exhaustive list of anti-competitive acts. These are:

(a) squeezing, by a vertically integrated supplier, of the margin available to an unintegrated customer who competes with the supplier, for the purpose of impeding or preventing the customer's entry into, or expansion in, a market;

(b) acquisition by a supplier of a customer who would otherwise be available to a competitor of the supplier, or acquisition by a customer of a supplier who would otherwise be available to a competitor of the customer, for the purpose of impeding or preventing the competitor's entry into, or eliminating the competitor from, a market;

(c) freight equalization on the plant of a competitor for the purpose of impeding or preventing the competitor's entry into, or eliminating the competitor from, a market;

(d) use of fighting brands introduced selectively on a temporary basis to discipline or eliminate a competitor;

(e) pre-emption of scarce facilities or resources required by a competitor for the operation of a business, with the object of withholding the facilities or resources from a market;

(f) buying up of products to prevent the erosion of existing price levels;

(g) adoption of product specifications that are incompatible with products produced by any other person and are designed to prevent his entry into, or to eliminate him from, a market;

(h) requiring or inducing a supplier to sell only or primarily to certain customers, or to refrain from selling to a competitor, with the object of preventing a competitor's entry into, or expansion in, a market; and

(i) selling articles at a price lower than the acquisition cost for the purpose of disciplining or eliminating a competitor.

The common feature of these anti-competitive acts is an exclusionary purpose or effect. Thus, the presence or prospect of competitive entry or expansion into the relevant market (which need not be the market in which the respondent is dominant) would appear to be essential to achieve a remedy from the Tribunal.

Conversely, the practice would not appear to be directed to remedying monopoly practices by a firm in its dominant market where there was no real competition or no reasonable prospect of competition: in the extreme, a market supplied by a "natural" monopoly.

Apart from this qualification, the Act invites an "I know it when I see it" approach to identifying a practice of anti-competitive acts. In practical terms, these are defined by the nature of the way they lessen competition, the extent of market control of the dominant firm, and the extent of existing and prospective competition. Thus it is quite difficult to make specific or discrete advice on each element of the practice.

The Tribunal's remedial power, while broad, is cast as a prohibition aimed at removing the undesirable effect on competition. It therefore does not imply direct government regulation of the manifestation of dominance (for example, prices). And the Tribunal's discussion of enforceable merger consent Orders makes it clear that a properly fashioned dominance prohibition would have to permit the Tribunal to stand back and watch rather than participate with the dominant firm's management in restoring competition.

### 3. NutraSweet Case

#### *(a) DIR Application*

On June 1, 1990 the DIR filed a Notice of Application with the Competition Tribunal requesting Orders against the NutraSweet Company under the abuse of dominant position, exclusive dealing and tied selling provisions of the *Competition Act*.

NutraSweet is the principal supplier in Canada of aspartame, an intense sweetener used as a substitute for sugar in a variety of food products. The application noted that NutraSweet controls about 95 percent of the market for aspartame in Canada and that its principal competitor, Tosoh Canada Ltd., a subsidiary of Holland Sweetener Company of the Netherlands, supplied approximately three percent of the market.

The application contended that aspartame constitutes a distinct product market from sugar and other artificial sweeteners for a variety of reasons: it provides an alternative to sugar for diabetics and weight-conscious consumers; it is not harmful to the teeth; it is non-caloric unlike other bulk sweeteners; and it is distinctive from other intense sweeteners such as saccharin and cyclamates because of the much greater range of food products and applications for which it has been authorized under the Food and Drug Regulations.

The alleged anti-competitive acts, exclusive dealing and tied selling requirements, flow from the same set of alleged contractual provisions which, as a whole, the DIR contend had prevented the creation of a separate Canadian market for the sale of aspartame. The DIR's application alleged that these acts constituted predation and sophisticated price discrimination practices.

The acts alleged by the DIR included:

(1) Use of NutraSweet's U.S. position to foreclose competition in other countries through entering into worldwide exclusive supply contracts of several years' duration with the parent companies of the largest purchasers of aspartame in Canada (principally soft drink manufacturers).

(2) Inducing exclusivity through the structure of its supply contracts. The relevant provisions include customer obligations to purchase their entire supply of aspartame from NutraSweet; customer obligations to use aspartame as the sole sweetener in their products; and a variety of fidelity rebates which the DIR alleged are designed to induce customers to purchase all of their aspartame requirements from NutraSweet. These fidelity rebates were alleged to include volume discounts, incentives for encouraging others to purchase aspartame from NutraSweet, and allowances for the display of NutraSweet's trademark or brand name on a customer's packages. The DIR contended that, in order to remain competitive, a NutraSweet customer must take advantage of all the rebates offered by NutraSweet under its supply contracts. As a result, the customer was effectively forced to purchase its entire supply of aspartame from NutraSweet and to affix NutraSweet's trademark to its packaging.

(3) Extending patent rights through exclusive contracts. The DIR contended that, immediately before the expiration of its Canadian patent, NutraSweet negotiated a number of long-term, exclusive supply contracts for aspartame which, the DIR alleged, ensured the maintenance of NutraSweet's dominant position in the Canadian market regardless of whether its patent had expired.

(4) Creation of market transparency to control competition. The DIR alleged that, through contractual terms with its customers (which were ostensibly aimed at maintaining the customers' competitiveness), NutraSweet was able to obtain knowledge of its competitors' activities and to meet the competition in a fashion that substantially lessened competition. The DIR contended that these agreements take several forms: "Meet or release" clauses (also known as "English clauses") which allow customers to obtain competitive offers for aspartame but also permit NutraSweet to meet the competitor's price if it were lower or to release the customer from the supply contract if NutraSweet elected not to meet the offer; an "extended release" clause which permits one customer to go to

another for aspartame in the event that another third-party customer of NutraSweet aspartame is released from its supply contract; a "most favoured nation" clause which requires NutraSweet to ensure that the customer is not charged a price for aspartame which places it at a competitive disadvantage in its own industry.

(5) The combination of most favoured nation and fidelity clauses. The DIR alleged that the combination of these terms induce customers to purchase their entire supply of aspartame from NutraSweet because customers can become free riders on the lower prices obtained by other aspartame customers and therefore have no incentive to seek lower prices on their own.

(6) Abuse of trademark. The DIR contended that NutraSweet's practice of providing allowances to those customers which place NutraSweet's trademarks on their products creates barriers to entry since the competitor's price must both justify the cost of removing the trademark and cover the foregone trademark display allowance.

(7) Selling below acquisition cost or long-run average cost. The DIR also alleged that the net prices charged to certain Canadian customers after all of the above discounts, allowances and rebates are less than NutraSweet's average acquisition cost or long-run average cost in production of aspartame.

Accordingly, the DIR contended that these alleged anti-competitive acts have foreclosed the aspartame market in Canada to potential alternative suppliers; the Canadian market is not open to competition at all due to the worldwide contracts negotiated outside Canada which require exclusive use of NutraSweet's aspartame in Canada; and there is no incentive for customers to seek alternative sources of supply because of the price preferences and other measures noted above.

The DIR also relied on the contractual provisions which he alleged constitute anti-competitive acts as the basis for asserting that NutraSweet has practiced both exclusive dealing and tied selling.

To establish exclusive dealing, the Director's application referred to the alleged presence of exclusive worldwide supply contracts; exclusive supply provisions in individual contracts; the affixing of the NutraSweet trademark on customers' product labels; exclusive dealing inducements through the presence of English clauses; most favoured nation clauses; trademark display allowance provisions; cooperative marketing rebate schemes; fidelity rebates; and free product clauses in NutraSweet's arrangement with its customers.

The DIR alleged that tied selling had occurred because NutraSweet, as conditions for the supply of NutraSweet's aspartame required customers to affix the NutraSweet trademark to their products and to refrain from using another brand of aspartame in conjunction with NutraSweet's brand. The DIR also alleged that the provision of substantial allowances for trademark display in a number of NutraSweet's supply contracts together with other fidelity clauses constituted inducements to meet these conditions.

The Orders requested by the DIR relating to abuse of dominant position, exclusive dealing and tied selling were similar. They prohibited world-wide contracts with multinational customers governing the supply of aspartame to Canadian affiliates; they prohibited the requiring of customers to purchase their entire supply of aspartame from NutraSweet; they prohibited the selling of aspartame to Canadian customers at below acquisition cost, and the granting of customer price concessions and other allowances not available to competitors of the customer for the same agreed volume of aspartame.

As well, the DIR applied for a declaration that the contractual provisions noted above were of no force or effect and could not be judicially enforced by NutraSweet. The DIR also requested the Competition Tribunal to order NutraSweet to include a most-favoured-nation clause in all supply contracts of customers which compete with each other in selling products containing aspartame if such a clause was included in a contract with any of them.

Finally, the DIR sought a declaration that any contracts entered into by NutraSweet or its affiliates pursuant to worldwide contracts were of no force or effect insofar as they affected the supply of aspartame in Canada and that NutraSweet could not require minimum exclusive annual volume commitment in any supply contract which was greater than 50 percent of a customer's total annual volume requirements of aspartame.

### *(b) NutraSweet's Reply*

The NutraSweet response, filed on July 25, 1989, contended that the firm's success in the market was purely the result of innovation, risk-taking and superior competitive performance. The respondent contended that its superior competitive performance was the result of continuous research and development, testing of aspartame to obtain approvals in various countries, intensive promotion, and a superior product and supply network, none of which had been undertaken by its competitors.

NutraSweet also contended that it had no market power in the supply of aspartame for a number of reasons including the following:

(1) extensive in-house research and development of artificial sweetener is now being conducted by manufacturers of food products;

(2) large food and beverage manufacturers can readily manufacture aspartame once it comes off patent;

(3) competition and supply of aspartame will intensify towards the end of NutraSweet's U.S. patent in 1992;

(4) no barriers to entry exist in Canada for manufacturers that currently supply aspartame.

NutraSweet also noted that its principal customers were large and sophisticated and could readily choose among competing suppliers; that prices for aspartame have been declining rather than increasing; and that contracts for the supply of aspartame were freely negotiated and had short time commitments that facilitated frequent competitive overtures from other suppliers.

NutraSweet denied that aspartame might be regarded as a distinct product market. The firm suggested that aspartame, as well as many other natural and artificial sweeteners, competed for the same ultimate customers and that aspartame fulfilled the same purpose as all other sweeteners. NutraSweet also noted extensive research and development activity by drug and food companies to improve and invent artificial sweeteners.

With respect to the geographic market, NutraSweet contended that Canada was not the appropriate geographic market, but that, rather, given the very low cost of shipping artificial sweeteners and the number of plants in existence in a variety of countries, the geographic market was global.

NutraSweet contended that the contractual practices which the DIR regarded as evidence of policy to maintain market pre-eminence were, in fact, all provisions sought by NutraSweet's customers to secure benefits for themselves or were normal commercial practices.

NutraSweet claimed that exclusive use and worldwide contracts were negotiated by customers to obtain secure supplies and consistent high-product performance. Volume discounts and cooperative marketing are regarded as normal commercial practices by NutraSweet. Trademark display allowances provide a benefit to customers through cost reductions of aspartame and, in turn, facilitate NutraSweet in protecting the goodwill of its trademark. "Meet or release" and "price protection" clauses, NutraSweet contended were actually sought by its customers to permit them to maintain their own competitiveness, particularly in the soft drink market.

### *(c) Tribunal Decision*

The Tribunal's decision was published on October 4, 1990. The Tribunal concluded that the practices of abuse of dominance, tied selling and exclusive dealing were present and issued a remedial Order.

At the time of writing, NutraSweet had appealed the decision to the Federal Court, and the DIR had cross-appealed seeking different remedies than those imposed by the Tribunal.

With respect to the issue of market definition, the Tribunal examined the market for all sweeteners and assessed the cross-elasticity of demand between high-intensity and high-calorie sweeteners and regulatory barriers facing suppliers of high-intensity sweeteners. The Tribunal found that there was no direct evidence of competition between aspartame and caloric sweeteners, and only weak evidence of indirect competition between high-intensity sweeteners. However, the Tribunal felt that no other high-intensity sweetener was a good substitute for aspartame across large market segments. The Tribunal therefore decided to define the product market as aspartame since it mattered little whether the definition was "aspartame" or "high-intensity sweeteners" because of the very limited degree to which non-aspartame, high-intensity sweeteners were present in the Canadian market.

In assuring market control, the Tribunal focussed on entry barriers. The Tribunal concluded there were significant entry barriers comprising patent portfolios, economies of scale and sunk costs.

The DIR had argued that market control meant control over supply as defined by the normal dictionary meaning. NutraSweet argued that it meant "market power." Market power would mean an ability to set prices above competitive levels for a considerable period.

The Tribunal accepted the respondent's position, stating however:

> This finding is of little practical import because, ultimately, all relevant indicators of market power must be considered in determining whether there is likely to be a prevention or lessening of competition substantially.

Having accepted the respondent's definition of control, the Tribunal proceeded to assess whether large buyers, such as Coca-Cola and Pepsi, were able to protect their interests through their own strong bargaining position. The Tribunal concluded that, although Coca-Cola and Pepsi have considerable resources to protect their interests, this did not in and of itself eliminate NutraSweet's market power. The Tribunal concluded:

> The evidence that NSC possesses appreciable market power given its market share (over 95% of sales in Canada), entry conditions and the constraints operating on its largest customers is sufficiently compelling so that the boundaries of substantial control need not be explored. Its "control" is clearly substantial.

With respect to "class or species of business" the DIR argued that these words should be interpreted in the commercial sense rather than in an economic sense, and that, accordingly, the business of NutraSweet was the manufacture and supply of aspartame. The Tribunal took the view of the respondent, however, that "class or species of business" is the same as the relevant product market.

The Tribunal's interpretation of "class or species of business" is an important decision, particularly since it contradicts the Eddy Match decision of the

Quebec court, under the old monopoly section. The Tribunal justified this distinction in the following manner:

> Based on the facts in Eddy Match Co. and the different legislative schemes of the *Combines Investigation Act* and the *Competition Act*, the Tribunal does not believe that this case provides a sound basis for identifying "class or species of business" without referring to possible substitutes. The court in that case was seized with charges under a criminal statute, a case in which the accused had engaged in highly aggressive conduct towards other producers of wooden matches; Eddy certainly acted as though wooden matches were sufficiently distinct so that it was worthwhile for it to concentrate its efforts on that industry. In the present statute, however, s.79 provides other remedies and the deciding body is a specialized tribunal. It would run contrary to the spirit of this legislation for the Tribunal to eschew other relevant factors (that is, possible substitutes) on some presumed technical ground.

The decision by the Tribunal that it will not necessarily follow previous jurisprudence under the *Combines Investigation Act* in criminal matters is an important indication of the Tribunal's view of the purpose of the 1986 revisions.

The Tribunal then considered the requirements of a "practice of anti-competitive acts" as contained in section 79. In this area also, the Tribunal's decision is an important precedent. It stated:

> This list of anti-competitive acts is clearly not meant to be exhaustive and the respondent admits that other conduct not specifically mentioned in s.78 can constitute an anti-competitive act. A number of the acts share common features but, as recognized by the Director and the respondent, only one feature is common to all: an anti-competitive act must be performed for a purpose, and evidence of this purpose is a necessary ingredient. The purpose common to all acts, save that found in paragraph 78(f), has an intended negative effect on a competitor that is predatory, exclusionary or disciplinary.

This finding indicates the Tribunal believes there must some element of intent or purpose to constitute an anti-competitive act.

The Tribunal interpreted "practice" as follows:

> If there is a good reason to avoid a limiting interpretation of "practice" under criminal law, it is all the more important to do so under s.79. The anti-competitive acts covered in s.78 run a wide gamut. Some almost certainly entail a course of conduct over a period of time, such as freight equalization in paragraph 78(c), whereas others consist of discrete acts, such as the setting of product specifications in paragraph 78(g). The interpretation of "practice" must be sufficiently broad so as to allow for a wide variety of anti-competitive acts. Accordingly, the Tribunal is of the view that a practice may exist where there is more than an "isolated act or acts." For the same reasons, the Tribunal is also of the view that different individual anti-competitive acts taken together may constitute a practice. It is important to stress, however, that this does not in any way relieve the Director of the burden of establishing an anti-competitive purpose for each of the acts.

The Tribunal then considered how one would establish an anti-competitive purpose. The DIR submitted that this test could be met through evidence of subjective intent, such as verbal or written statements of personnel of the respondent, or through a consideration of the nature of the act itself, the latter being based on the premise that a corporation intends the necessary and foreseeable consequences of its acts. The Tribunal accepted the Director's position. It also indicated that, in most instances, the purpose of a particular act will have to be inferred from the surrounding circumstances.

With respect to meet or release clauses, the Tribunal found that large customers, such as Coca-Cola or Pepsi, used them as a way of mitigating the effect of being locked into an exclusive contract. The Tribunal stated:

> If exclusive supply is objectionable in the instant case, so is a meet or release clause: by making exclusivity more acceptable to customers it serves as an inducement for customers to enter into exclusive arrangements.

With respect to the most favoured nation clause whereby NutraSweet contractually agreed to offer its best price in its contracts, the DIR had argued that this was an inducement to exclusive dealing. The Tribunal found that:

> The Director submits, correctly in the Tribunal's view, that only a firm with a very large market share can be expected by its customers to provide a most-favoured-nation clause because only it will almost certainly be selling to the customers' competitors.

However, the Tribunal appeared not to find all of these practices as anti-competitive acts. The Tribunal stated:

> The Tribunal sees little purpose in the context of the present case in determining whether each clause constitutes an anti-competitive act. It is doubtful whether the meet or release and most-favoured-nation clauses would exist in the absence of an explicit or implicit exclusive supply agreement. In the Tribunal's view, the issue is whether the agreements requiring exclusive supply and all the contract terms related to it, have an exclusionary purpose. The Tribunal is persuaded that this is the case.

The DIR had alleged that NutraSweet had engaged in the anti-competitive act set out in paragraph 78(i) of "selling articles at a price lower than the acquisition cost for the purpose of disciplining or eliminating a competitor." The Tribunal accepted the respondent's argument that acquisition cost is not easily applied in a manufacturing situation. The Tribunal also found that the language of the paragraph suggested that Parliament intended it to be applied mainly to distribution situations where the articles would be resold.

While limiting the application of paragraph 78(i), the Tribunal considered the broader issue of whether there could be an anti-competitive act or some form of predatory pricing not specified in section 78 but nevertheless, caught by the dominance provisions. The Tribunal, in an important conclusion, stated that it was satisfied that the section was broad enough to cover other forms of predatory pricing. The Tribunal then considered the appropriate test for predatory pricing and basically concluded that the Areeda-Turner test is the appropriate standard (that is, prices are presumed not to be predatory if they exceed average variable costs). This is similar in principle to the Stage II test under the Bureau's proposed Predatory Pricing Bulletin.

The DIR had alleged that NutraSweet was using its patent in the United States to gain a competitive advantage in Canada. This U.S. market power was alleged to have been used with Coca-Cola and Pepsi in particular. The

Tribunal accepted the Director's position that the use of a monopoly position in one country to obtain a competitive advantage by a dominant firm in another market constitutes an anti-competitive act.

With respect to proof of substantial lessening of competition, the Tribunal stated:

> The factors to be considered in deciding whether competition has been or is likely to be substantially lessened are similar to those that were discussed in concluding that NSC has market power. In essence, the question to be decided is whether the anti-competitive acts engaged in by NSC preserve or add to NSC's market power.

In summary, the particular acts the Tribunal found to be anti-competitive were exclusive supply and use clauses, logo display allowances, cooperative marketing allowances, meet or release clauses, and most-favoured-nation clauses. The Tribunal also included the use of U.S. patents to foreclose competition by a system of rebates on exports from the United States to induce Canadian importers to have only NutraSweet aspartame in their products. The Tribunal, therefore, concluded that those practices were having the effect of preventing or lessening competition substantially.

## IV. COMPETITION ACT COMPARED WITH *NATIONAL TRANSPORTATION ACT, 1987* AND RELATED LEGISLATION

### A. INTRODUCTION — HISTORICAL PERSPECTIVE

The *National Transportation Act, 1987* (NTA, 1987) represents the most recent legislative milestone in a process of staged reduction in direct federal regulation of intercity transportation services that has continued since the 1960s.

However, federal regulatory policy for the transportation industry was not static between the 1968 and 1987 revisions to this industry-specific legislation. For example, during this period, largely due to competitive pressures from expansions in trucking as a substitute to rail freight and from passenger air deregulation in other jurisdictions, regulatory and policy changes increased the operating flexibility of rail service and air carrier managers.

To some extent, particularly in relation to air carrier regulation, the 1987 revision mirrored rather than advanced prevailing regulatory policy of the Canadian Transport Commission.

However, the NTA, 1987 did not significantly alter the principal institutional and administrative elements established in the NTA of 1967, for the delivery of the federal government regulatory product for this sector.

By way of contrast, as discussed in Parts II and III, the 1986 revision of the *Competition Act* included both major substantive changes geared to increase effectiveness and predictability as well as major institutional changes involving the establishment of the Competition Tribunal and "decriminalization" of Canada's merger and monopoly laws of general application. These changes have facilitated a more hands-on and proactive approach to competition law enforcement.

In fact, the substitution of civil for criminal process and substantive standards can be regarded as an overall trend in the evolution of Canadian competition law that is not confined to the 1986 revision. Prior to the 1976 revision of the *Combines Act*, the law was entirely based upon criminal law prohibitions. The 1976 revisions introduced a range of reviewable practices relating to non-price vertical restraints to competition which were regarded as manifestations of inefficient monopolization — as well as new criminal prohibitions respecting unfair and inefficient marketing practices. These prohibitions are now being reviewed by the Bureau as possible candidates for decriminalization. Charter requirements may ultimately force decriminalization of the conspiracy prohibitions. And, in light of the structure of the abuse of dominant position practice, it is now probable that this provision, together with the Bureau's draft predatory pricing policies, and not the criminal predatory pricing prohibitions, will be the general future context for Bureau action respecting anti-competitive unilateral pricing practices.

This comparison of the *National Transportation Act, 1987* and the *Competition Act* looks at both the institutional arrangements for law enforcement and the substantive law established by each Act.

The comparison is based on a point-in-time snapshot of two streams of economic regulation. It is probable, in my view, that enforcement and substantive provisions of both Acts will be significantly amended within the decade.

## B. *NATIONAL TRANSPORTATION ACT, 1987* AND RELATED LEGISLATION

As noted in Part II, the *Competition Act* does not apply, by operation of common law, to commercial activities that are otherwise authorized or regulated by valid legislation. Nor does it apply to agents of the Crown. The 1986 revisions have, however, made the *Competition Act* applicable to certain Crown corporation activities. And, as noted below, this exemption of regulated conduct can be, and has been, overridden by legislation.

### 1. Substantive Provisions

The *National Transportation Act, 1987* and related legislation establishes discretionary regulatory authority to control the following intercity commercial behaviour of intercity passenger transportation service suppliers:

- *Intercity rail transport:*

  (a) entry is dependent upon a public convenience and necessity finding;

  (b) tariffs are subject to review and variance if found not to be in the public interest. (By contrast, rail freight rates are required to be "compensatory" using a standard based on a statutory average variable cost coverage that has been elaborated by extensive regulatory cost accounting rules.)

- *Intercity domestic air transport:*

  (a) Southern and Northern Canada ("designated area"):

  Domestic service basic fare increases may be rolled back or disallowed, upon complaint, if unreasonable and if there is no alternative, effective, adequate and competitive transportation service.

  (b) Northern Canada (only):

  Limited entry and exit restraint based upon locality and assessment of impact on competitors.

  Service level and points served subject to licence restrictions.

- *Intercity bus transport:*

  Jurisdiction delegated to individual provinces which employ a range of discretionary entry, exit and price controls of varying intensity and effectiveness. No material substantive changes have been made in the *Motor*

*Vehicle Transport Act* (MVTA), *1987* compared to the MVTA of 1954 with respect to extra-provincial bus transportation. Provincial regulatory policies all involve an element of protection of incumbent firms from competitive entry to help sustain a higher level of service (and lower prices) in less dense markets. In some cases, overall limits to firm profitability have been applied through the tariff approval process. Corporate profitability constraint appears to have been of diminishing importance over the last decade.

The NTA, 1987 also retains certain *non-discretionary regulatory controls*:

(a) Acquisitions of Canadian Transportation Undertakings (all intercity passenger rail, bus and air suppliers) having in excess of $10 million in assets or annual sales are subject to prior public notice and approval (which approval may be deemed after a certain period of time by operation of the statute). Disallowance requires a finding that the acquisition is against the public interest.

(b) Entry by non-resident air carriers is subject to compliance with state-to-state agreements which comprehend carrier designation, points served, freedom of the air and capacity offered.

(c) Non-resident voting share investment in domestic air carriers is limited to 25 percent.

The NTA, 1987 expressly provides that its regulatory regimes affecting base air fares and acquisitions do not affect the operation of other Acts of Parliament. Accordingly, the *Competition Act*'s merger and abuse of dominance jurisdiction (to the extent that high pricing may be construed as an anti-competitive act) continues to operate and to run in parallel to these NTA regimes.

## 2. Institutional Features

The *principal institutional features* of the 1987 NTA revision are:

- Implementation and enforcement of discretionary and non-discretionary regulatory controls by an independent expert tribunal, the National Transportation Agency (the Agency), supported by its own staff and having an option to exercise its substantive powers following public hearings, and possessing disclosure powers to support its enquiries. The structure of this regulatory agency is essentially the same as its predecessor the Canadian Transport Commission (CTC). The Agency and CTC are therefore not distinguished in our analysis of the behaviour of regulatory agencies (section D below). *The absence of a dynamic restructuring of the regulatory agency at the same time that federal regulatory discretion over the transport sector was being reduced, in my view, has created a potentially unhealthy tension between the new regulatory law and the institutional values and methods of the Agency that applies it.*

- Expanded opportunities for Cabinet intervention in Agency decision-making through binding policy directions to complement the pre-existing power to vary or rescind any Agency decision. (This power has, to date, proven to be academic).
- Reformulation of an elaborate "Parliamentary statement of national transportation policy" which the Agency is expected to implement through the exercise of its regulatory discretion. This policy seeks a safe, economic, efficient and adequate network of viable and effective transportation services making the best use of all available modes of transportation at the lowest total cost. As implementation guidance, the policy identifies:
  - (i) competition and market forces as the prime agents;
  - (ii) economic regulation only where necessary to serve the transportation needs of shippers and travellers but with no "unfair" limit on competition;
  - (iii) balancing commercial viability with regional economic development objectives;
  - (iv) that carriers bear a "fair share" of the costs they cause;
  - (v) that carriers receive "fair" compensation for public obligations; and
  - (vi) that fares be non-discriminatory and not create an undue obstacle to trade.

This policy statement arguably places more emphasis on the role of competition and market forces than did its predecessor in the NTA of 1967.

However, the potential impact of this shift, or any one of the enumerated policy goals for that matter, is left uncertain by the sheer variety of policy statements and their contradictory implications. Parliament, in my view, has through unclear legislative policy (particularly when compared to the *Competition Act*) still left the Agency with ample room to act as an arbitrator of competing political and economic interests and to perpetuate institutionalized economic performance values carried over from the CTC era.

## C. JURISDICTIONAL RELATIONSHIPS

### 1. Retail Level

#### *(a) Exclusive Transportation Regulation Jurisdiction*

Based on the considerations presented in Part II, at present, federal transportation legislation, and not the *Competition Act*, would apply only to the following dimensions of intercity bus and rail service:

- unilateral high or low pricing behaviour or discriminatory tariff terms of intercity rail service suppliers;
- discriminatory or exclusionary conduct arising from the geographical scope and level of VIA rail services; and
- in provincial jurisdictions where intercity bus tariffs require regulatory approval, both unilateral high and unilateral low pricing behaviour by such suppliers, as well as the terms and conditions of service provision.

The *Competition Act*'s prohibitions against predatory pricing and abuse of dominant position (where the grounds are price gouging) would not apply in these circumstances.

Clearly, the remaining direct regulatory measures at the retail level which are applicable to intercity passenger transportation services have become quite limited. It would also be fair to say that the rate of erosion of direct economic regulation of retail pricing and terms of service has varied among modes.

Common carrier regulation for intercity bus service by blanket delegation of federal jurisdiction remains in the hands of provincial governments. In terms of process and substantive decision rules, this form of regulation remains largely the same as it has been for 20 years.

Passenger rail regulation jurisdiction is largely unchanged although there is increased scope to regulate service access for persons with disabilities and greater Cabinet and corporate discretion over the geographical scope and level of service.

Retail pricing regulation in intercity air transport is now restricted to a discretionary power to roll back basic service price increases. To date this power has not been exercised. Low pricing, and scheduled service terms and conditions and service levels (outside the designated area, that is, Northern Canada) are now not subject to direct regulation.

*(b) Parallel Jurisdiction*

Two areas of parallel jurisdiction confirmed by statute have already been noted: (1) high unilateral pricing by air carriers within Canada; and (2) mergers/acquisitions among transportation service suppliers.

However, there are major differences in the manner in which these jurisdictions may be exercised under federal regulatory and competition law.

These differences are examined below with respect to procedural administrative matters.

There is also, in my view, parallel regulatory and *Competition Act* jurisdiction in relation to certain structures or conduct of intercity passenger service.

First, the conspiracy provisions of the *Competition Act* may be employed to challenge high or low pricing behaviour of the intercity bus industry, even where this conduct is approved individually for each firm under a prior provincial tariff approval requirement, where such behaviour flows from an agreement among suppliers. This position is based upon a more restrictive interpretation of the Law Society of British Columbia case (see Part II, section B) than advanced by some commentators. Specifically, it is my view that more recent jurisprudence has confirmed that the conspiracy prohibition would be ousted in relation to the conduct of regulated firms or professions *only* where the agreement is authorized either expressly or by necessary implication by valid enabling legislation.

It should be kept in mind that the governing structure of the legal profession considered in the Law Society of British Columbia case is a statutorily required collective agreement regime. However, provincial bus regulation is generally premised upon individual tariff applications being made by individual licensees rather than upon collective rate approval. Conceivably, there could be an exception from the conspiracy provisions where the provincial bus regulation regime expressly provides for the filing of joint tariffs by suppliers in the same geographic market (as opposed to joint tariffs respecting the provision of a particular service such as transportation between A and B using more than one licensee).

On the same basis, the conspiracy provisions of the *Competition Act* would have parallel application with the NTA, 1987 with respect to air carrier entry, exit and terms of service matters (to the extent the latter is not prescribed by regulation but is rather determined by the Agency on a case-by-case basis) which remain subject to some direct Agency regulation in the designated area.

Further, it is arguable that the definition of abuse of dominant position is sufficiently broad and flexible to apply to some conduct of an intercity bus or air carrier (in the designated area) where:

- the carrier's market dominance is the result of restrictive regulatory entry policies; and
- the regulator either lacks the jurisdiction or the practical opportunity to order cessation of the anti-competitive acts or to eliminate the opportunity to conduct them through either franchise elimination (delicencing) or allowing greater competition by licensing alternative suppliers.

As a practical matter, however, the Bureau of Competition Policy would probably not assert jurisdiction at this time in such a situation due to (1) the lack of jurisdictional certainty, (2) the likelihood that the markets involved are intra-provincial as opposed to national, and (3) the minor impact on economic efficiency and consumer welfare that the anti-competitive acts would entail.

### *(c) Exclusive* Competition Act *Jurisdiction*

At the retail level, therefore, in my view, the *Competition Act* is the exclusive trade practices regulation instrument with respect to:

- predatory pricing and abuse of dominant position by air carriers (that is, pricing and other acts aimed at eliminating competition);

- resale price maintenance by air, rail and bus services; and
- non-price vertical restraints such as refusal to deal or tied selling practices by all modes of intercity passenger services where the transportation service is the tying product.

Because of the mode-specific nature of existing transportation regulation, it appears to be fairly clear that the *Competition Act* would apply exclusively to agreements to lessen competition (for example, price fixing and market sharing), including bid-rigging, involving more than one mode and non-price vertical restraints (for example, fixed selling and market restriction) between modes.

### *(d) Remaining Uncertainties*

As discussed in Part III, section B, "article" under the *Competition Act* includes evidence of the right to transportation. The prohibition of price discrimination in this Act applies to discriminatory sales among competitors and also to discriminatory promotional allowances. Where the retail price of an intercity transportation service requires regulatory approval, it is arguable that the price discrimination prohibition does not apply at common law, since any discrimination has been lawfully authorized. However, where no express price approval is required, but there is a complaint-based appeal mechanism, it is arguable that there is room for application of the price discrimination prohibition given its highly specific nature. In either case, it would appear that the prohibition against discriminatory promotional rebates would apply to the passenger service supplier since the focus of the *Competition Act* is on a collateral service rather than on the regulated transportation service itself.

## 2. Input Market

### *(a) Introduction*

Apart from being mode-specific, perhaps the principal jurisdictional difference between transportation regulation laws and the *Competition Act* is that the former are focussed upon the retail level of trade while the *Competition Act* applies to both the input and retail levels of an industry.

Transportation regulation laws are to a large extent responses to perceptions either that the retailer of passenger services would have excessive market power without regulation, or alternatively, that market power should be generated by regulatory protection and directed to facilitate the pursuit of social policy objectives. *Such laws therefore do not (apart from the limited area of railroad access) provide a comprehensive instrument for eliminating market failures and inefficiencies that increase ultimate consumer costs or reduce ultimate consumer choice. Stated another way, transportation regulation laws do not remedy a market failure or excessive market power relating to inputs to the regulated service.* At the same time, they represent a legislative assumption that the most serious market failure or market power problems exist at the retail level.

Such an assumption may be initially valid but it is difficult to maintain as market conditions evolve. A comparative virtue of the *Competition Act* is that the legislation itself makes no assumptions about where in the production process the most serious forms of market failure or excess market power are likely to be found. Thus, subject to the reservations discussed in (c) below respecting markets subject to very high entry barriers, competition law is arguably better positioned to attack the root causes of consumer welfare loss (the disease) as opposed to the end result of these causes (the symptoms).

By way of example, the Bureau of Competition Policy, and not the Agency or federal Transport Department, was the source of a remedy to preclude exclusionary practices from developing in the dominant Canadian computer reservation system (CRS) firm. There is no longer any industry, travel agent or consumer support to legislate common carriage requirements based on snapshot observations of what may or may not be a "natural monopoly." Since the Competition Tribunal's resolution of the Gemini/Reservec case (see Part III, section D), there do not appear to have been substantial complaints of preferential display or access from air carrier competitors, travel agency consumers, or suppliers of collateral services (for example, ground transportation and accommodation).

### *(b)* Competition Act *Jurisdiction*

The starting proposition therefore is that the *Competition Act* has exclusive jurisdiction in relation to passenger transportation service inputs. However, this jurisdiction is subject to two very basic limitations. First, for conduct to be actionable there must be a business relationship and also generally priced transactions. The evidentiary requirements of the Act's criminal prohibitions and reviewable practices cannot for all practical purposes be met where the supply of goods or services is not being rationed by private sector markets using a price system. This effectively removes the Act from the supply of public goods or government services whether as inputs or as end products.

The supply of government services (whether they are priced as otherwise supplied under a contract, or not) is also effectively exempted by the common law exemption relating to Crown Agents. As noted, the exemption was cut back in the 1986 revisions to the Act only with respect to the commercial activities of Crown corporations.

Thus, to the extent that market failure or excessive market power in government-supplied inputs to passenger transportation services have a negative impact on consumer welfare, such problems remain out of reach of the *Competition Act* and are subject to correction, if at all, only through Ministerial accountability. It is arguable that this accountability structure is least susceptible to the introduction of the market-creation measures implicitly favoured by competition laws to remedy problems of inefficient resource allocation.

### *(c) Comparison of Substantive Tests*

Regulation legislation for federal and provincial passenger service has largely adapted "public interest" and "reasonableness" tests to the determination of whether regulatory intervention is required in price, merger and supply decisions. Certain provincial statutes for the regulation of intercity bus service market entry and the *Railway Act*, with respect to railway market entry, contain a "public convenience and necessity" test.

All three tests are in practice equally broad. In fact, as legislative articulations of government decision-making discretion go, they are probably the broadest legislative grants of discretion that can be made. In the case of NTA, 1987 powers, it is possible to argue that the Act's statement of transportation policy limits regulatory discretion. However, in reality the policy statement is so extensively qualified and rife with contradictory objectives that can only be balanced on a case-by-case basis, that no real limitation to regulatory discretion has been created.

Thus, these federal and provincial regulatory laws effectively permit the decision maker to apply any set of economic or social criteria to define appropriate regulated firm conduct. Stated another way, there is no externally imposed reference for what is, or is not, in the consumer interest. Identification of that becomes a self-referential exercise based on references to and analysis of the regulatory jurisprudence under each regime together with the balance of interests represented in the overall decision-making process.

Accordingly, there is nothing in the substantive tests of existing transportation regulation laws that would prevent the decision-makers from adopting the standards of anti-competitive behaviour of the *Competition Act* as, at the very least, difficult-to-rebut presumptions of behaviour that is not in the consumer interest even though administrative law rules require the decision making to retain some discretion and objectivity to support case-by-case adjudication.

On the other hand, the decision-making tests of the *Competition Act*, reviewed in Part III, are much more highly articulated and clearly focussed upon economic concepts and standards. This Act itself provides considerable guidance in such areas as the definition of anti-competitive acts of a dominant firm, the characteristics of anti-competitive non-price vertical restraints to trade, and the criteria for merger impact assessment.

Additional detailed guidance has been provided by the Bureau itself on key matters such as market definition of what is unreasonably low pricing, and what constitutes a substantial lessening of competition. The level of detail in this guidance may appear daunting but it is designed to permit private interests from anticipating Bureau action with the greatest possible precision. The Bureau is in a better position to provide such guidance and to bind itself to it as its role is administrative and does not involve adjudication. The Bureau is therefore not constrained by administrative law rules that require regulatory agencies to retain impartiality and decision-making discretion.

In my view, the criteria of the *Competition Act*, as supplemented by the DIR guidelines on price discrimination, predatory pricing and mergers discussed in Part III, are to a high degree consistent with prevailing microeconomics theory in the situations where individual firm behaviour is likely to result in a net reduction of consumer welfare within the economy as a whole.

That is not to say that firm behaviour which is not actionable under the *Competition Act* would never disadvantage particular consumers or groups of consumers for a certain period of time. Such a guarantee of course cannot be made in a competitive market system where government trade regulation is designed to be applied on an exceptions basis. Rather, the *Competition Act* addresses the overall impact on consumer welfare in the product and geographic markets served by particular firms. Through the use of economy-wide conduct standards, the Act attempts to ensure that all such markets are subject to the same restraints and therefore that all markets operate under the same incentives and opportunities to maximize outputs and profits.

The basic assumptions of competition law are that:

(1) markets are subject to competition; and

(2) markets (including both buyers and sellers) optimally respond to prevailing price signals.

The first assumption, however, cannot be readily satisfied if the industry is most efficiently supplied by a single firm, or barriers to entry preclude competitive responses to high pricing or exclusionary conduct.

An efficient monopoly exists in a particular market where the marginal unit costs of supplying the relevant product in the relevant geographic market are least if there is one supplier, over the longer term, without any artificial barriers to entry or exit in the market. This requires constantly increasing economies of scale and/or scope for the industry as a whole in the market for the entire level of demand in the long term even as technology changes.

These conditions are very difficult to satisfy. Very high, fixed, start-up costs (high economic entry barriers) coupled with a capital-intensive business structure and assets which have little or no alternative use or secondary market value (high economic exit barriers) are often considered as necessary conditions for a natural monopoly. Plant- or firm-level economies of scale or scope are, however, generally not regarded as sufficient for a natural monopoly in a particular market. As well, the more rapid the pace of technological change (and hence the greater the capacity to innovate) and the more physically mobile or generic the principal assets of firms in a market are, the less likely an industry is to meet the economic conditions for a natural monopoly.

High entry barriers can also be created by government regulation, trade policy, government procurement preferences and capital market imperfections.

In other words, the current *Competition Act* and, in my view, probably any form of competition law which aims at preventing consumer welfare losses from private sector restraints to trade on an exceptions basis, is not likely to prevent monopolistic conduct in industries characterized by high concentration and/or high entry barriers. Specifically, the current abuse-of-dominant-position practice is clearly directed at forestalling monopolizing behaviour (behaviour that is directed at reducing competition) in intrinsically competitive markets. It seems almost axiomatic that an efficient monopoly or a firm that becomes more efficient as competition is eliminated could not practice anti-competitive acts in its own market since the elimination of all its competitors would result in production at the lowest possible costs.

Classical economic theory suggests that a firm that profit-maximizes in an industry with very high entry barriers would undersupply the market relative to a situation of competitive supply. The firm would price-discriminate according to consumers' ability to pay in order to appropriate to itself as much consumer welfare as it could.

However, these reservations do not apply to the extension of monopoly or market power from that base market to other intrinsically competitive markets. The *Competition Act* has several reviewable practices specifically tailored to preventing such anti-competitive monopolization.

The second assumption behind competition law cannot readily be met where consumption and production decisions are so fraught with non-price externality effects that prices cannot be used as a benchmark of resource value trade-offs. Equally, markets fail if prices cannot be created or collected. These latter conditions define a pure unpriced public good.

The former externality conditions define situations where market failure may be addressed to a limited extent by what economists call "second-best" solutions through subsidized or mandatory consumption (where prices exceed marginal social value resulting in insufficient consumption) or by the imposition of social cost taxes, mandatory consumption restrictions and/or mandatory product design rules to minimize social costs not reflected in the price (where prices are less than marginal social value).

Safety regulations are an example of this first situation; applied in a market on an evenhanded basis, safety regulation imposes general costs akin to taxes. Such regulation therefore would not distort input prices to a degree that would make competition law impossible to apply because, in practice, adequate evidence could not be developed to support a remedial Order or criminal conviction. Safety regulation and competition law can therefore comfortably co-exist.

Pure public goods may readily be identified based upon the physical inability to exclude non-payers from the benefits of consumption by payers or conversely the physical inability to get users to pay for any socially useful level of production. They include policing and defence and possibly little else. They do not necessarily include goods originally provided by the state to accelerate or increase their production from what the private sector was then offering, but which now can be produced abundantly by private markets or which can now be effectively charged for (that is, potential free riders can now be excluded).

Whether the production or consumption of a non-pure public good is so enmeshed in externalities that prices are meaningless is largely a matter of political judgement.

However, to a significant extent such externalities can be minimized through consumption or product standards or explicit targeted subsidies in order to maximize the ability of individuals to exercise price-based choices. As a general proposition, consumer welfare as a whole would appear to be better served through a system of explicit and targeted subsidies and/or consumption standards for which there is clear political accountability than through a price system involving hidden internal and untargeted subsidies or hidden consumption standards.

## D. INSTITUTIONAL/ADMINISTRATIVE DIFFERENCES

### 1. Introduction

This section examines the institutional and administrative differences that exist between the government bodies that apply the substantive business conduct and industry structure standards of the *Competition Act* and the *National Transportation Act, 1987* and related federal and provincial passenger transport regimes.

As previously noted, there is no statutory or common law requirement that the National Transportation Agency or provincial intercity bus regulators adopt substantive decision-making criteria that *differ* from those of the *Competition Act* in those areas where their jurisdiction either parallels or excludes the operation of that Act. Such bodies apply sufficiently broad discretionary tests that fitting *Competition Act* criteria into them would be lawful even if the regulator had previously applied different criteria. The only requirement in doing so would be adherence to the administrative law rules of fairness or natural justice.

Any difference between the regulators' criteria and the prevailing standards of the *Competition Act* must therefore be regarded not as a legal requirement but as a result of the balancing of competing principles and interests established as legitimate through the individual regulator's institutional structure and/or through the decision making rules imposed upon the regulator by the courts, particularly due process requirements. It is also conceivable that the regulatory agency may employ due process standards which go beyond the minimum level required by the courts. It would do so to satisfy general political expectations respecting direct public involvement in decision making, or to increase the legitimacy of its actions by co-option of affected interests.

### 2. Regulatory Agencies — A Behavioural Profile

Procedurally, one thing can lead to another. Once having embarked upon a decision-making process that involves identification and ranking of legitimate or affected political or economic interests (a polling process), a regulatory agency will find it very difficult to order its priorities or to structure its decisions in a fashion which does not fall within a "range of reason" established by the positions of the interests involved in its decision-making process. Over time, a regulatory agency may also base its priorities upon the more dominant or persistent economic or political interests appearing before it (these can be producer, consumer or even governmental interests).

Under these circumstances it becomes very difficult for the regulatory agency in practice to implement priorities based upon objectives, such as maximization of competition which, over the long term, are relatively abstract and do not appeal to the direct economic interests that are involved in its decision making.

For example, *future* competitors are, by definition, never directly present in a decision-making process.

This difficulty increases with the vagueness or generality of the statutory decision-making criteria. This considerable vagueness is inevitable, in my view, once a regulatory agency model is adopted where investigation and adjudication are merged in a single institution. The absence of statutory or executive policy guidance and the resulting dominance of jurisprudence and consensus-oriented process also significantly reduce the ability of this form of regulatory agency to adopt dramatically different behavioural or structural standards for an industry to reflect changes in the industry's economic fundamentals.

Because a consensus-oriented, decision-making process involves a degree (often very significant over time) of interest-group brokering, there is often compelling pressure upon the regulatory agency to make decisions that are "fair" to the interests involved. The tendency is bound to increase to the extent that the regulator's enabling legislation does not provide detailed and internally consistent decision-making standards.

Finally, because regulatory decisions, particularly where public hearings are involved, take on some jurisprudential value, and because a closely knit group of producers with strong expectations for consistency of regulatory policy/jurisprudence (the regulated sector) are involved in its decision making, it becomes extremely difficult politically for a regulatory agency to amend significantly its objectives or priorities. Typically the initiative to change objectives or priorities comes from an exogenous "shock to the system," such as dramatically different market conditions affecting the regulated sector, government policy, or (most rarely in Canada) judicial intervention.

Put simply, as the result of a combination of factors, regulatory agency decision making tends over time increasingly to broker competing economic interests through decisions that are politically legitimate (that is, fair). There is generally no internal correction or arresting mechanism in the agency's structure or in its instructions from the legislation to keep the agency from continuing along this slippery slope.

This correction must generally be imposed externally through legislative change (including deregulation). For reasons discussed below, other external options such as judicial intervention, legislative review of appointees or agency performance, executive policy guidance, and staff and decision-maker overhaul (such as is applied in the U.S. revolving-door approach) are not significant in the Canadian context.

It would be useful, therefore, to summarize the convergence of institutional and structural factors which support decisions that gravitate to political fairness and modest change rather than maximum competition and rapid change. These factors are in relation to Canadian regulatory agencies, such as the National Transportation Agency, that combine investigative and adjudicative functions and employ open public hearings in their decision-making process.

*(a) Absence of Clear Statutory or Executive Policy Guidance*

Tests such as "just and reasonable," "public convenience and necessity," "no undue discrimination," and especially "in the public interest" are no more than large receptacles for the case-by-case exercise of unconstrained administrative discretion. They have no substantive or operational meaning in and of themselves.

Regulatory statutes are seldom revisited by the legislature in a fashion which would cause a reassessment of priorities. Opportunities for executive policy guidance are few and largely unused.

*(b) Little or No Policy Accountability of Regulatory Appointments*

Appointments are often political rewards and almost never designed to ensure application of a particular economic policy. Appointees are often not selected because of their expertise and where expertise is a criterion, the expertise often is developed through involvement with incumbent producer interests. Reappointments or new appointments occur gradually over time; thus the complexion of regulatory agencies, much like the Supreme Court of Canada, is hard to identify and political balances are slow to change.

Appointees who do not perform effectively are almost never removed for cause before the appointments period ends. Rather they are not re-appointed. Few proposed appointees are even interviewed publicly by the legislature before the appointment is made, to identify either expertise or priorities. The legislature seldom reviews the substance of the agencies' decisions other than during brief examinations of financial requirements.

Notwithstanding the virtually unfettered review and override powers of Cabinet, and thus the opportunity for Cabinet to articulate in advance the circumstances under which overrides may occur, extremely few Canadian regulatory agency decisions are changed by the executive branch of government.

### *(c) Longevity of Staff Advisors*

In contrast to the fairly even and rapid turnover of agency appointees, Canadian regulatory agency staff tend to be employees of long duration with senior staff often recruited from the regulated sector itself or other branches of government that regard the particular regulated sector as a client from an economic development perspective. This difference tends to increase the influence of staff in the decision making and provides an important opportunity for the regulated sector to exercise decision-making influence outside formal or public elements of the process.

As well, the agency staff, rather than agency appointees, tend to be the source of industry expertise.

### *(d) Absence of Judicial Intervention*

Typically, judicial review of agency decisions is restricted to errors of law or jurisdiction, which can include insufficient procedural fairness, misinterpretation of statutory decision-making criteria, bias and acting for an improper purpose.

However, given the inherent vagueness of regulatory decision-making criteria and statements of legislative policy in Canadian regulatory statutes and the absence of constitutional economic rights, there are virtually no opportunities for judicial intervention into the merits of a decision.

As well, Canadian due process law respecting regulatory agencies is relatively new and costly and time-consuming to activate. It has to date not provided as effective a tool as American due process law in ensuring a balance between competing economic interests (for example, producers versus consumers) in access to regulatory information or access to decision-making activities (including off-the-record influence).

### *(e) Role of Public Hearings*

Public hearings can be a device for levelling the impact of resource disparities among competing economic interests. They also can be a double-edged sword. Public hearings open up at least some part of the overall decision-making process to a structured competition between the articulated merits of competing economic interests. On the other hand, public hearings are costly and, if there is no tradition of open access, public hearings can reinforce the impact of resource disparities between producers and consumers and favour advancement of the views of the traditional dominant player, usually the regulated sector as a whole or major incumbent firms.

The value of public hearings as a levelling device also decreases where their actual use or relative importance in the decision-making process cannot be predicted with accuracy. For example, regulatory agencies often have considerable discretion over whether or not to conduct a hearing in order to decide, and, if a hearing is conducted, considerable discretion over its role remains. In practice, if an agency's decision does not expressly state that the record of a hearing was ignored in making the decision, judicial intervention into the agency's reasons is highly improbable. The agency is thus free, in relation to the risk of judicial intervention, to ignore what might reasonably be supposed to be a key, if not determining, decision-making event.

## 3. Transportation Regulatory Agencies

Several considerations affect an assessment of the comparative capacities of direct regulatory intervention and competition law to protect consumer interests that relate to specific design features of economic regulators for Canadian passenger transportation services.

First, all such agencies have their genesis in a legislative presumption that the sector requiring regulation was subject to chronic and significant market failure. There are no deregulation provisions in the enabling legislation to permit the regulator to bail out of counter-productive intervention in the event that the circumstances causing market failure disappear. This neatly avoids any need by the regulator to review the underpinnings of its continued existence or, in the extreme, to consider self-destruction. Rather, in practice, it provides an opportunity for the regulator to fortify its continued existence by consciously promoting the continued validity of the presumptions that led to its existence in the first place.

The market failure prompting regulatory legislation appears to have differed among modes. For rail, it was a fear of natural monopoly power. For air and trucking, it was a fear that unconstrained competition was inherently destructive and would result in inadequate levels of service, rapid swings between over- and under-capacity and few incentives to invest. It is now recognized that, to a large extent, market failure rationales played a secondary role to the sheer political power of producer interests and were largely developed as after-the-fact ways of legitimizing interests wishing to maintain a regulated industry structure.

The concern over inadequate service levels also, before and after the fact of agency creation, provided a strong opportunity to generate a regulated sector price structure that was riddled with hidden but politically attractive internal subsidies. These subsidies reduced or eliminated the need for explicit government subsidies covering the start-up phase of the sector, or individual firms, avoided the uncertainty and political risks of their possible removal, and permitted the regulator to appear fair to competing consumer interests.

Finally, because transportation technologies developed at different times and the political balance of the federal and provincial levels of government has shifted over time, transportation regulation legislation has been historically confined to single modes (that is, technologies). Jurisdiction has been split between the federal and provincial levels based upon political rather than economic considerations. Rail and air services are federally regulated while road-based services are effectively provincially regulated. Public road passenger jurisdiction is also split at the provincial level between the province itself (buses) and its municipalities (taxis).

This historical accident has created an inherent bias within individual transportation regulation bodies to regard each mode as a discrete industry having a discrete market rather than functioning as a substitute for other forms of public or private transportation.

However, mode-specific analysis tends to avoid the real questions to be answered in identifying continuing market failure such as: given all available substitutes in providing transportation services within a particular geographic area to a discrete set of consumers (for example, passenger service consumers), is it possible for any one supplier or group of suppliers (without an agreement not to compete) to earn monopoly profits or to stay in business while providing an unacceptable level of service?

Mode-specific analysis also tends to discourage an examination of the impact of enforcing traditional hidden subsidies, through regulated prices in a particular mode, on the long-term survival prospects of that mode where technological change offers new effective substitutes.

### 4. Competition Law Contrasted

#### *(a) Substance*

There are major differences in the substantive conduct standards of competition law and the direct regulation model and in the manner in which these standards are applied. These differences are critical to an assessment of the relative merits of each approach for the future protection of intercity passenger service consumer interests. They may be summarized as follows:

(i) Statutory industry performance standards are more explicit under competition law.

(ii) Competition law remedies are designed to be transitory. Firms or industries subject to competition law intervention and restraint have this restraint lifted by the courts or the Competition Tribunal once the statutory prerequisites for restraint disappear or circumstances change.

(iii) Markets, and hence the presence of market failure, are defined in a consistent manner for all aspects of the economy free of institutional presumptions or any market analysis of the presence of functional substitutes and the prospective impact of competitive entry regardless of the technology employed to produce the final product. This, in my opinion, makes competition law, as a general law of general application, a more effective instrument for assessing the effects on a particular sector or industry of evolving market or technological conditions. Competition law also encourages an analysis of the consumer impact of firm or industry behaviour which emphasizes the likely response of competitors or investors to that behaviour over the current performance or structure of an industry;

(iv) Competition law precludes intervention to generate hidden consumer subsidies through price structures and therefore places the subsidy responsibility directly on the appropriate legislature. The objectives of economic efficiency, industry development and wealth distribution are thus not commingled in a murky jurisprudential soup that militates against public accountability over the adoption of often non-complementary policies;

(v) Finally, in my view, the overall set of actionable behaviour under Canadian competition law is largely congruent with the behaviour described by established microeconomic theory as most likely to reduce consumer welfare through higher prices, reduce choice or reduce innovation. In contrast, the open-ended nature of transportation industry regulatory intervention standards creates an opportunity to make actionable behaviour which could enhance consumer welfare. A possible exception to this observation is, as noted previously, a situation of natural monopoly.

### *(b) Process/Administration*

There are also very basic differences between competition law and transportation regulation administration. Competition law is enforced equally against all elements of the economy with the investigative or fact-finding process occurring in private without there being any enforceable involvement by affected economic interests. Competition laws are adjudicated in a strict judicial environment even where the Competition Tribunal is the adjudicator. The adjudicator is exposed only to a series of "one-off" issues relating to specific behaviour of a specific firm.

On the other hand, transportation regulation is enforced only with respect to specific industry components with fact finding involving some enforceable input rights for affected interests. Issues are adjudicated in a less judicial and more political environment. The ultimate decision maker is exposed to what amounts to a continuum of issues relating to the business policies of that particular industry component.

These differences, in my view, have resulted in compelling incentives for transportation regulators to go beyond the level of intervention necessary to maximize consumer welfare. They should become a "second layer of management" which attempts to strike a delicate balance, within a non-managerial environment, between competing suppliers, consumers and industry development goals. They should use a statutory framework that encourages decisions to be made on the grounds of fairness. The decision-making structure of transportation regulation, as with other industry-specific regulatory regimes which constrain competitive industries, contains a variety of elements which collectively create a bias in favour of protecting incumbent supplier interests. This ultimately leads to a less than fully efficient development path for the industry as a whole.

### *(c) Conclusion*

The substantive and administrative structure of competition law appears to provide reasonable assurance that consumer welfare will be maximized in the supply of transportation services, as with other services, with the exception of those transportation services that are demonstrably natural monopolies. There is a built-in tendency of transportation regulation to import and balance, largely in a hidden unaccountable fashion, policy considerations which are different from, or in conflict with, consumer welfare maximization. Competition law in my view is a superior instrument to transportation regulation to maximize consumer welfare, and therefore to protect consumer interests.

An exception to this general proposition could be made where regulatory protection was determined to be an appropriate transitory policy during the infancy period of a new industry (to be "sunsetted" once a sustainable and competitive industry structure was achieved). However, on balance, regulatory protection would appear to be an excessively risky instrument to distribute wealth among consumers. There are too many serious industry inefficiencies caused by the prices and entry barriers necessary to sustain cross subsidies.

# V. TRANSPORTATION INDUSTRY DEVELOPMENTS: APPROPRIATE TRADE PRACTICES FRAMEWORK

## A. INTRODUCTION

This part examines the suitability of competition law regulation of trade practices, and the likely approach of the Bureau of Competition Policy towards complaints, in relation to the following industry developments:

(1) increased cross-modal ownership (for example, bus and air feeder services);

(2) infrastructure access arrangements and pricing;

(3) airport defederalization;

(4) road privatization;

(5) intercity bus service deregulation;

(6) air carrier entry and price deregulation in Northern Canada;

(7) increased competition from non-Canadian suppliers (for example, fifth freedom or cabotage rights provided to U.S. carriers; increased airport access under bilateral arrangements); and

(8) passenger ferry privatization.

## B. INDUSTRY DEVELOPMENTS

### 1. Cross-Modal Ownership

A competition law analysis of industry structure and concentration of ownership changes is conducted in relation to the relevant product and geographic market rather than changes in the relative financial or bargaining power among firms engaged in a particular transportation mode. Such an analysis would consider the nature of economic and regulatory entry barriers in each mode and whether it was likely that increased cross-modal ownership would, on a case-by-case basis, foreclose single-mode competitors from important sources of customers and interconnecting traffic.

There would only be a potential competition law concern if the respective modes supplied the same markets or if one mode was an essential input to another market. No concern would arise if there were no apparent economic or regulatory barriers to entry into the relevant market. Economic barriers to entry would be examined in relation to the extent of fixed and start-up costs, and the capacity of customers to switch suppliers.

Given the low economic entry costs in most transportation services, the mobility of transportation assets (excluding roadbed which is generally separately owned), and the maturity of development of the passenger transportation sector, there is little reason to conclude that the basic set of trade practices controls of competition law would not satisfactorily prevent industry behaviour that did not result in maximization of consumer welfare.

Without regulatory entry barriers, there is little chance of an actionable competition law issue arising. This further supports the relative desirability of the less interventionist administrative structure of competition law.

### 2. Infrastructure Access Arrangements and Pricing

This next section examines the usefulness of the *Competition Act* in constraining anti-competitive behaviour with respect to controlling access to essential "bottleneck" inputs to the production of passenger transportation services. These inputs include access to airport terminal facilities, railway, roadbeds and highways.

Before proceeding with this discussion, it should again be emphasized that the *Competition Act* itself does not permit the application of social, environmental or industrial development policy goals on economic decision making. It takes the prevailing price system or conditions of supply as given. To the extent that these prices or conditions of supply reflect such policies, the *Competition Act* becomes an increasingly less effective instrument in encouraging economic efficiency and consumer welfare.

This inverse relationship should, of course, not be surprising since it essentially reflects the overall balancing being made by society through its laws. Economic efficiency as measured purely by private transactions and their prices is balanced against overall social welfare, the measurements of which become permeated with subjective and political judgements because of the presence of important perceived, but not easily measured, consumption and production externalities.

For example, assume that roadway usage charges for large, energy inefficient passenger cars were set by a supplier well above the long-run marginal costs imposed on the roadway by such cars in order to discourage their consumption and thereby to reduce pollution. It would be far more difficult for the Bureau of Competition Policy to examine a complaint from a manufacturer or rental car supplier that the pricing practice had anti-competitive effects (for example, in relation to competition with public transit including intercity buses, or smaller car suppliers) than if the roadway usage prices had been set using the principles of marginal cost pricing.

The following discussion will therefore assume away pressure favouring substantial "social policy" pricing in the commercial supply of transportation infrastructure access.

Two situations are considered: (1) the supplier of infrastructure access is also a supplier of passenger transportation services which require the infrastructure or which compete with services that require that infrastructure (a vertically integrated supplier); and (2) the supplier of the infrastructure is *not* vertically integrated with a supplier of passenger transportation services.

In both instances, assume that the infrastructure supplier is the sole supplier in a geographic market but that there is no regulatory licensing barrier to prevent or control new infrastructure suppliers in that market.

*(a) Vertically Integrated Supplier*

This situation could arise, for example, if

(i) roadway access was supplied by a commercial Crown corporation or an investor-owned firm which also controlled or had a significant investment in suppliers of public transit, intercity buses or taxi-type passenger transportation services;

(ii) rail access was supplied by a commercial Crown corporation or an investor-owned firm which also controlled or had a significant investment in a passenger rail service or intercity bus service supplier; or

(iii) airport access was supplied where the airport owner was a commercial Crown corporation or an investor-owned firm which also controlled or had a significant investment in an airline.

The *Competition Act* contains several quite clear provisions directed at preventing vertically integrated suppliers with strong market power in one market from extending that power through exclusionary or discriminatory pricing practices into a second, more competitive market made up of unintegrated suppliers or customers.

In situations where the vertically integrated infrastructure supplier was attempting to control access through discriminatory pricing against third-party customers, discriminatory access conditions, or outright refusals to supply access, the following provisions would apply:

(i) *refusal to deal:* Assuming infrastructure access is supplied on a commercial basis, then the Competition Tribunal could order the infrastructure owner to supply access to parties on usual trade terms if there is a refusal to supply but access is in ample supply, and the third-party passenger service supplier is substantially affected or precluded from carrying on business due to an inability to obtain adequate supplies. This inability must result from insufficient competition, and the third party must be ready, willing and able to meet the infrastructure supplier's usual trade terms;

(ii) *abuse of dominance:* The illustrative anti-competitive acts set out in the *Competition Act* include "squeezing, by a vertically integrated supplier, of the margin available to an unintegrated customer who competes with the supplier for the purpose of impeding or preventing the customer's entry into, or expansion in, a market" (this is aimed at dominant supplier price discrimination), and "pre-emption of scarce facilities or resources required by a competitor for the operation of a business, with the object of withholding the facilities or resources from a market" (this is aimed at discriminatory supply conditions by either a vertically integrated or unintegrated supplier either to inhibit competition or to obtain monopolistic profits).

As previously noted, dominant position and the effect of a substantial lessening of competition from the practice of anti-competitive acts must also be proven using a civil law standard of proof.

There is, as has been discussed, a considerable jurisprudence under the *Competition Act* dealing with exclusionary practices and pricing by vertically integrated suppliers. In some cases, such as the supply of replacement Chrysler auto parts or aspartame sweetener, the supplier, subject to a Competition Tribunal review application was, in effect, a monopoly.

Clear applicability and orientation of the *Competition Act* are not in doubt. The question is whether the Act and its administrative apparatus provide a sufficiently practical and timely way of remedying this form of anti-competitive behaviour.

It would be inappropriate to focus only upon the average turnaround time of litigated cases before the Competition Tribunal that ultimately result in a Tribunal remedial Order. The bulk of complaints arising under the reviewable trade practices provisions of the Act are settled informally, after Bureau intervention outside the formal inquiry process, to the apparent satisfaction of complainant and supplier. This suggests that timely remedies on an informal basis are the norm. As well, suppliers are increasingly relying upon opinions of the Bureau, provided under its Program of Compliance to structure their businesses.

One interesting option may therefore be, at the time at which infrastructure access is to be put on a commercial basis, to require, as a condition of business transfer to the new supplier, that the new supplier obtain and adhere to a Program of Compliance opinion on how to avoid *Competition Act* violations.

With respect to the practicality of the remedy that may be provided under the *Competition Act*, the refusal to deal and abuse of dominance provisions should be distinguished. The refusal to deal remedy is resumption of supply on normal order terms — it does not allow for an offset for advantages obtained from past anti-competitive behaviour. However, abuse of dominance provides a more sweeping power to the Tribunal if a cease and desist order is not likely to restore competition: to order whatever is reasonable and necessary to overcome the effects of the anti-competitive practice in the market, *including* divestiture of the firm against which the Order is directed.

### *(b) Non-Vertically Integrated Supplier*

As previously discussed, the abuse of dominance position provisions of the *Competition Act* are, in my view, not well suited to preventing market failure in markets where a single supplier is most efficient or where there are extremely high economic or indirect regulatory entry barriers. Although the abuse of dominance provisions do include a divestiture power, this power is, from a practical standpoint and in relation to the overall remedial structure of the Act, a power which would be seriously considered only in exceptional circumstances. Moreover, divestiture of a supplier which is, in effect, a geographical natural monopoly may not be a complete answer if the only result is the creation of a number of smaller geographic natural monopolies.

As well, the overall orientation of the *Competition Act* is towards the remedy of transitory problems in inherently competitive markets.

Consequently, the situation of the unintegrated monopoly supplier should be examined both in terms of its home market and in terms of its impact as a supplier of inputs to competitive retail level passenger transportation services.

The same analysis as applied to vertically integrated infrastructure suppliers would apply to the unintegrated supplier with respect to price or supply discrimination among customers in relation to commercially available products. The motive and consequences of anti-competitive behaviour would, however, become substantially more difficult, although certainly not impossible to establish if the infrastructure supplier did not have a direct economic interest in a transportation service competitor. However, the case could still be based upon the comparative impacts of discriminatory prices that do not reflect marginal costs or discriminatory supply restrictions on competitive firms.

Both the evidentiary problems and conceptual orientation of the abuse of dominance provisions become significantly greater when inter-competitor discrimination is not an issue, but instead, the complaint arises from perceived inefficiency, excessive prices and profits, or absence of innovation on the part of the unintegrated sole supplier. In short, this is the traditional problem of monopolistic profits, goldplating, and dulled performance that has supported both government ownership and public utility regulation.

Previously noted was the illustrative anti-competitive act of "pre-emption of scarce resources" which conceivably could be extended to monopoly under-supply of a market (which classical economics theory suggests will occur with a profit-maximizing monopoly). However, in my view, this is stretching the scheme of abuse of dominance as presently written.

As well, it appears uncertain whether there is an effective remedy available to the Competition Tribunal in these circumstances. The Tribunal has no authority to control prices or profits or to require the provision of yet-to-be supplied products. As noted, the divestiture power is not likely to be any help in these circumstances.

Thus, in my opinion, either amendments to the *Competition Act* or a separate regulatory regime would be necessary to control the monopoly power of an infrastructure supplier that was not manifested in discriminatory pricing or supply conditions among its customers.

On the other hand, it does not necessarily follow that the only real options are government ownership (the effectiveness of which is not examined in this report) or direct (public utility-type) regulation of services, profits and products.

For example, the infrastructure supplier's pricing behaviour could be made subject to the *Competition Act*, but its overall corporate performance could be subject to non-regulatory incentives such as a periodically renewed franchise tied not to the continued operation of the business but to management of the business. A remedial trusteeship of specified duration could be imposed by government to supplant incumbent management if profits, costs or the level of overall innovation appeared unreasonable upon a periodic corporate performance review. Another option, which arises at privatization, is the retention of a "golden share" in the hands of government which, coupled with a shareholder's agreement, requires government or third-party review of overall corporate performance, but not specific pricing and supply decisions.

Such options would, in my view, not cast a cloud over the applicability of the *Competition Act* to pricing and supply decisions. To assess their effectiveness, they should be compared to direct regulation of access prices and conditions by an independent agency.

The principal benefit of direct intervention is that government control of industry behaviour would be regarded as fairer and less-hidden since decision making would occur in a more public and consensus-oriented forum. Access prices and conditions certainly, or stability, if they are considered to be important outcomes, do not require direct regulation to be realized since price transparency and minimum-price duration requirements could readily be made through franchise renewal or divestiture conditions.

On the other hand, assuming that monopoly profits can be precluded through franchise renewal or divestiture conditions, the regulatory agency option, as it has developed in practice in Canada, runs the risk of establishing prices that are no more conducive of efficient economic behaviour than is current rationing of capacity on non-price basis. A regulatory agency is also a costly administrative apparatus that adds considerably to the complexity of supplier decision-making.

To some degree, this problem of natural monopoly performance could also be mitigated if, in the course of infrastructure privatization, the infrastructure was broken up into a substantial number of distinct geographical monopoly suppliers. To operate, these suppliers would have to enter into traffic exchange or joint operating arrangements with each other in order to be efficient.

Two conditions would prevail: (1) these suppliers would have strong financial incentives to maximize traffic and obtain access to other infrastructure suppliers at minimum cost, or (2) there would be consumer transparency among infrastructure suppliers.

Condition (1) could arise, for example, in a privatized road system where users were billed by one "home-base" system for all travel, but could shop around for the most economic home-base supplier. Condition (2) could arise where all road services were billed on a usage basis, and the prices of all road service suppliers were separately identified on each bill.

Such a market structure could impede monopoly practices through the balancing of bilateral local monopoly bargaining power. It might also produce sufficient price comparisons of firms with similar cost structures and comparable (but not identical) terms of supply to permit an analysis of whether any one firm might be subject to a remedy under abuse of dominant position.

Here, however, an effective anti-conspiracy control (again possibly taking the form of a binding Bureau Compliance Opinion) would be essential to ensuring the establishment of useful "shadow market" information, and to prevent industry-wide coordination practices.

### 3. Airport Defederalization

The discussion in (b) applies to the supply of airport facility access. Airport access is presumably supplied on a quasi-commercial basis. The constraint to current application of the *Competition Act* is ownership: airport access is provided by a federal department, the supply activities of which remain exempt from the Act by operation of the common law on Crown Agent coverage.

If airports were sold to private investors or a Crown corporation of either the federal or provincial governments, there is no doubt that the *Competition Act* would then apply. If airports were sold to municipal governments, the Act would also apply since such governments are statutory creatures. However, municipalities have the capacity to become Crown Agents if expressly made Crown Agents by legislation.

Notwithstanding that airports are presently subject to exclusive federal regulatory jurisdiction, it still appears possible for the provincial Crown to make airports Crown Agents thus exempting them to the extent possible from the *Competition Act* until that Act is amended to cover all Crown Agents.

### 4. Road Privatization

In addition to vertical integration and natural monopoly issues discussed in subsection 2 above, road privatization also raises the issue of the capacity to price, bill and collect on bills — an issue that in effect defines whether roads should continue to be regarded as potentially private goods, as opposed to the current view that roads are a pure public good.

Without an actual pricing system for roads, even with privatization to a firm subject to the *Competition Act*, the capacity of this legislation to prevent behaviour that reduces consumer welfare would be low. However, it could apply to contractual access terms which could constitute abuse of dominance, for example, measures directed at frustrating competitive entry.

### 5. Intercity Bus Service Deregulation

The only serious barrier to intercity bus service deregulation is the presence of a significant degree of geographic cross-subsidization which is considered to be necessary to maintain the current geographic coverage of bus service. This requires an assessment of barriers to entry and probably pricing of new entrants services in "thin markets."

This industry segment is not a natural monopoly. Buses, like freight transport trucks, are low-cost, highly mobile and self-sufficient factories. On this basis it would appear that the *Competition Act* provides a sufficient trade practices regime for this industry.

### 6. Air Carrier Entry and Price Discrimination in Northern Canada

Again the effectiveness of competition law as a consumer protection instrument should be examined in light of the structure of the air services sector under this regime, particularly entry barriers, and the availability of modal substitutes.

Clearly the availability of modal substitutes to passenger air services is less in Northern Canada than in Southern Canada. However, the capital cost associated within Northern route entry appears to be quite modest in relation to thick interurban route entry in Southern Canada since many Northern markets can be well served with small propeller-driven passenger aircraft. As well, passenger service in Northern Canadian routes would appear to be virtually a joint product with the supply of cargo services, since a relatively high proportion of goods consumed in Northern communities (and particularly high-value goods) is shipped in via air. Thus there would appear to be quite low barriers to entry into supplying air passenger services to the region as a whole and to particular origin-destination pairs in that region.

On the other hand, given the overall importance of air transportation to such communities, and the vulnerability that comes with remoteness, security of supply becomes a more important element of the overall consumer interest than with respect to other passenger service modes. Even a service disruption of as short a period as a week can be of major concern to Northern communities. This is the basis for the entry and exit restrictions established in the *National Transportation Act, 1987*.

Under Canadian competition law, competitiveness in terms of rate of new entry has traditionally been measured in longer time frames than are likely to be tolerated by Northern Canadian consumers of passenger or cargo air services. However, if a solution were to continue to be provided with respect to security of supply, it would appear that, given the overall inherent competitiveness of this air transport industry segment, competition law could be satisfactorily substituted for the other direct regulatory constraints of the *National Transportation Act, 1987*. A mandatory exit waiting period as a condition of an operating licence granted under a "fit, willing and able" test could be sufficient. A supplementary measure, if warranted, might include a security deposit or bond to permit community chartering of replacement service in the event of a breach of this waiting period condition.

Finally, as a general proposition based in part on airline deregulation in the U.S., particularly Alaska, a program of direct thin-route subsidies may be a low-cost and easily administered option for maintenance of supply security.

### 7. Increased Competition from Non-Canadian Suppliers

This issue may be considered in relation to both air and bus passenger services. However, the geographic coverage of U.S. or overseas air service suppliers is clearly greater. And the most immediate prospect of competitive entry is from U.S. carriers having a significant existing transborder business.

The principal issue for consumer protection is whether foreign-based suppliers would have an incentive and an ability to enter the Canadian market at low prices, force Canadian incumbents out of the market, and then raise prices to levels that would otherwise not be possible.

More succinctly, the issue is the likelihood of successful foreign supplier predatory pricing, or effective service "dumping," to use the international law equivalent.

First, it should be noted that the predatory pricing, price discrimination and abuse of dominance provisions of the *Competition Act* apply to all prices charged in Canada by persons engaged in a business in Canada. Thus, it would be incorrect to assume that, because the *Special Import Measures Act*, which contains Canada's anti-dumping regime, does not apply to the importation of services, there is no Canadian law applicable to predatory pricing of service imports. The *Competition Act* applies to the supply of such imports in Canada.

Any uncertainty as to whether a foreign-based passenger services supplier was engaged in a business in Canada could adequately be overcome by:

(i) requiring an identifiable presence in Canada as a condition of supplying Canadian origins or destinations;

(ii) requiring that business presence to provide adequate security by way of a performance bond or other security deposit; and

(iii) making compliance with Canadian pricing laws a condition of entry and continued Canadian business rights.

It is in this context, that consumer protection measures beyond the *Competition Act* should be examined.

Prerequisites for effective predatory pricing are:

(i) capacity in other markets to raise prices above competitive levels to fund entry through predatory prices; and

(ii) a capacity to withstand further entry in the market where predatory pricing has been practiced to reduce or eliminate incumbent competition.

This requires an analysis of the level of competition and barriers to entry in both the established and the new market. With respect to the U.S. air transport sector, there is a very high degree of excess plant capacity (unused operating aircraft). This strongly suggests that there is little or no incentive or capacity on the part of U.S. air carriers to use revenues in the U.S. market to fund sustained below-incremental cost entry into Canada since both the "home base" and the Canadian markets are intrinsically highly competitive and have low economic entry barriers. Equally, the low entry and exit barriers in air transport would strongly suggest that any post-predation attempt to raise prices above competitive levels would be quickly met by price competition.

The only possible basis for effective U.S. based, air service predation into the Canadian market would be an agreement among all U.S. suppliers authorized to enter the Canadian market not to compete among themselves domestically and in Canada in a fashion that would permit post-predation joint monopolization of the Canadian market. The agreement not to compete in the U.S. to facilitate this export cartel strategy would of course be subject to U.S. anti-trust laws which are much more severe than the *Competition Act*. The agreement would also be subject to the conspiracy prohibition of the *Competition Act*. These exposures would have to be weighed against the prospective permanent benefits of a U.S.-supplier, market-sharing arrangement governing the Canadian market.

This joint monopolization scenario appears very remote. Not only is an effective joint monopoly unlikely, but, in my view, U.S.-based suppliers are unlikely to risk U.S. anti-trust sanctions and the prospect of being shut out of the Canadian market under a treaty arrangement as part of a Canadian government response.

Accordingly, the remote likelihood of successful predation as part of further U.S. air service entry supports reliance on competition law as the appropriate trade practices regulation instrument with respect to U.S. air services competition.

Basically the same analysis applies to support reliance on competition law with respect to U.S. bus service entry.

This analysis, however, may not apply with equal force to further entry by non-U.S. based air services since these services are by-and-large national monopolies or obligations, and entry into these foreign national markets is often very strictly controlled. Thus, there may be a domestic market structure that might support successful predation. However, for such services the question must be asked whether any such national carrier would have a real business incentive to practice predatory pricing in the Canadian market, especially since such pricing behaviour would be very easy to detect quickly. In all likelihood, there would not be a greater incentive or capacity to predate successfully by such suppliers.

The *Competition Act*, therefore, would probably provide the appropriate regulatory framework for non-U.S. air service entry as well.

### 8. Passenger Ferry Privatization

The same considerations respecting natural monopoly power as were discussed in subsection 2 in relation to infrastructure access arise also in relation to marine ferry privatization.

The *Competition Act* as presently structured would not readily provide an adequate restraint to the exercise of market power unless competition were introduced through privatization. This could be through the sale of ferries serving a route to more than one supplier, coupled with a fairly strict anti-conspiracy control (possibly implemented by the Bureau of Competition Policy under its existing program of negotiating informal compliance undertakings).

In the event that all ferries serving a market were sold to one firm, there may be a need for some form of public-utility type of price and service regulation. This would be particularly true if the sale included the docking facilities or a franchise in the market.

# VI. CONCLUDING REMARKS

Part IV examined the substantive, structural and administrative differences between the *Competition Act* and the general characteristics of transportation regulation legislation and regulatory agencies.

The analysis has largely focussed upon the general institutional characteristics of economic regulation as applied in Canada through independent regulatory agencies and the legal and institutional characteristics of Canadian anti-trust or competition law enforcement.

It is not possible, in my view, to conduct an empirical comparative analysis of the economic results of the decisions of the Bureau of Competition Policy and the National Transportation Agency (the Agency). There is a dearth of jurisprudence under the *Competition Act*. But this is even more so with respect to the *National Transportation Act, 1987* since there have been only very few litigated cases producing reasons with respect to pricing, entry, exit and merger of passenger transportation firms — or all transportation firms under the Agency's jurisdiction for that matter. There are no "smoking guns" of a good or bad application of economic principles under either jurisdiction to date.

In any event, for policy-making purposes, a more appropriate focus, is upon the long-term consequences of applying certain combinations of legal standards and institutional delivery mechanisms.

Transportation regulation regimes, due to a combination of factors, are less likely to encourage industry behaviour which is consistent with maximizing consumer welfare over the longer term when compared to competition law. Exemptions to this finding can be made, however:

(1) where an industry or a particular component of it is in its early stages of development and requires some protection from competition to overcome capital market inadequacies or to maximize the locating of a particular industry in Canada;

(2) where there are no transactions or transaction prices in the supply of a product; and

(3) where in the market under consideration there is a single supplier, high entry barriers, and the concern is excessive prices or profits.

Competition law applies a clearer and more rigorous set of rules in the prevention of trade practices which reduce consumer welfare. These principles are consistent with prevailing economic analysis of practices that are most likely to reduce consumer welfare.

But, as noted, competition law in general, and the *Competition Act* in particular, is not well suited to providing an effective remedy to the market failure known as "natural monopoly" or where pure public goods are supplied.

The *Competition Act* does not presently cover commercial activities of the Crown (as opposed to Crown corporations).

The *Competition Act* also remains in an evolutionary state due to uncertainty over the constitutional underpinnings of the key conspiracy and merger provisions and continuing dispute over the appropriateness and economic rationale for criminal prohibitions against price discrimination.

The *Competition Act* and its administrators presently suffer a "legitimacy" disadvantage in a democratic society where enduring regulatory legitimacy depends upon some degree of openness of administration and even public involvement in decision making. Presently all inquiries under the Act must take place in private, and public involvement in adjudication is strictly limited by judicial and Competition Tribunal criteria in granting standing to intervene. This impediment to establishing ongoing legitimacy is made all the more apparent when competition law administration is compared to the regulatory environment which involves more open fact-finding and adjudicative processes.

Nevertheless, the Bureau of Competition Policy has slowly but consistently tested the limits on its fact-finding activities and has become more forthcoming in the presentation of its analysis of informally settled matters. It would be possible to relax the legislated privacy requirement without undermining the objective of maintaining confidentiality. For example, the Bureau could be required to present more details on the results of its inquiries in its Parliamentary Report without naming the subjects of each inquiry.

In addition, there is increasing business reliance on, and respect for, the provision of detailed compliance opinions as part of the Bureau's Program of Compliance. Such proactive measures will become increasingly available and useful as the shift from a criminal law to a civil law environment for enforcing Canadian competition law is implemented in practice.

# CHARTS

The following charts provide a snapshot of the current jurisdictional coverage of the *Competition Act* and the *National Transportation Act* and underlying provincial bus regulation discussed in Part IV and the relative merits of competition law and direct economic regulatory law in addressing the future developments review in Part V.

## *Chart 1:*<br>COMPARATIVE JURISDICTIONS: COMPETITION ACT VERSUS PASSENGER TRANSPORTATION AND PROVINCE, PART IV

| | ***Competition Act*** | **NTA, Provincial Bus Regulation** |
|---|---|---|
| Mergers | x | x |
| Predatory pricing price discrimination | x | x<br>(busing, rail passenger only) |
| Agreements to lessen competition | x | |
| Vertical restraints (refusal to supply tied selling, market restriction, exclusive dealing) | x | |
| Industry structure level of competition (entry, exit, terms of service) | | x |
| Abuse of dominance (monopolizing conduct) | x | |
| Excessive prices (monopoly profits) | | x |

## Chart 2
## ASSESSMENT, PART V

| | *Competition Act* | **Direct Regulation** | **Possible Other Measures** |
|---|---|---|---|
| 1. Increased Cross-Modal Ownership | current provisions adequate | parallel jurisdiction not necessary | |
| 2. Infrastructure Access and Pricing | for (a) to (c) Act requires amendment to cover all Crown Agents | generally a second-best solution | linking Bureau compliance opinion with dissolution or privatization |
| (a) Customer Discrimination | abuse of dominance and non-price vertical restraint provisions adequate | not desirable — high risk of introducing non-economic "fairness" criteria | |
| (b) Supply Restriction | no means of requiring new products or increased overall supply | no means of requiring new products or increased overall supply | • periodic franchise review<br>• golden share<br>• break up territorial monopolies into smaller units<br>• increase infrastructure supplier interdependence subject to strict anti-collusion control |
| (c) Excessive Prices/Profits | no effective remedy if market supports only one firm | public utility regulation of prices and profits feasible but carries significant risks of dulling innovation and technological change | see 2(b) |
| 3. Airport Defederalization* | amendments to cover all Crown Agents desirable | not necessary (see 2) | creation of a private gate-and-landing-time market subject to *Competition Act* compliance opinion and undertakings |
| 4. Road Privatization | See 2 | See 2 | See 2 |
| 5. Intercity Bus Deregulation | provisions adequate — industry has low entry barriers | not necessary if very large geographic cross-subsidies are not required | |

*Chart 2 (cont'd)*

## ASSESSMENT, PART V

| | *Competition Act* | **Direct Regulation** | **Possible Other Measures** |
|---|---|---|---|
| 6. Air Carrier Deregulation (Northern Canada) | provisions adequate | | • retention of exit notice period<br>• direct thin-route subsidy |
| 7. Non-Canadian Competition | provisions adequate | retain only if domestic industry protection is more important than efficiency or consumer welfare | • remove 25% foreign ownership limit<br>• liberalized entry under bilaterals |
| 8. Passenger Ferry Privatization<br>(a) monopoly profits<br>(b) price discrimination<br>(c) service quality | <br>not adequate<br>not adequate<br>not adequate | second-best solution compared to periodic franchise review<br>review and price limit | periodic franchise review with price cap condition |

* **This section relates only to transfer of airport ownership and operating responsibility from the federal government to other governments or to the private sector. Controls for monopoly power abuse are examined in 2 and are relevant regardless of the ownership or operating structure for airports.**

## ENDNOTES

1. *R. v. Carnation Co.* (1969), 4 D.L.R. (3d) 133
   - no practice where prices are a temporary expedient to meet competition.

   *R. v. Consumers Glass Co.* (1981), 124 D.L.R. (3d) (Ont. H.C.J.)
   - prices are not unreasonably low if accused is minimizing losses where there is excess industry capacity.

   *R. v. Hoffmann-La Roche Ltd.* (No. 1 and 2) (1981), 125 D.L.R. (3d) 607 (Ont. H.C.J.)
   - what is unreasonably low is a question of fact depending on all the circumstances.

2. In September 1991, the Bureau published revised draft guidelines. These guidelines do not differ substantially from the April 1990 draft examined in this report, with the exception that the more recent draft does not so explicitly propose a two-stage screening process.

3. This definition is taken from 1990 Draft Merger Enforcement Guidelines, which have been superseded by the Merger Enforcement Guidelines, Information Bulletin No. 5, March 1991 which adopt essentially the same features.

4. Consumer and Corporate Affairs Canada, *Information Document on the Proposed Acquisition of Wardair Inc. by PWA Corporation*, CCAC No. 189 10234E, (Ottawa, April 1989), p. 3.

5. Ibid., p. 4.

6. Ibid., pp. 4–5.

7. Ibid., p. 6.

8. Ibid., p. 6.

9. *Reasons for Consent Order Dated July 7, 1989*, Competition Tribunal, CT-88-1, *DIR v Air Canada*, et al., pp. 69–70.

# 8

# CONTROLLING MARKET POWER IN WEAKLY CONTESTABLE CANADIAN AIRLINE MARKETS

Keith Acheson and Don McFetridge*

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## 1. INTRODUCTION

In recent years, the structure of the Canadian airline industry has undergone important changes. Air Canada (AC) has been transformed from a government-owned airline with special responsibilities and privileges to a private company competing on an even footing with Canadian Airlines International Limited (CAIL). Like AC, CAIL is a product of corporate metamorphosis and privatization. Pacific Western Airlines, formerly an Alberta Crown corporation, bought CP Air and Wardair to form CAIL. AC and CAIL link the larger Canadian centres and provide international service.

While these structural changes were taking place, regulatory change was also occurring. Elements of former policy were abandoned including the regional airline policy, introduced in 1966. In its stead, new and distinct regulatory regimes govern the North and the South. Although there is more regulatory flexibility everywhere in the system than previously, control over fares and route adjustment is tighter in the North than in the South. The regions and small communities are now served by feeder airlines, aligned by contract and equity positions with AC or CAIL, and a diminishing cast of independents. The feeders and independents provide commuter service between smaller communities and link travellers to the networks of the major Canadian and foreign carriers. Some of the larger independents have offered service between large cities in competition with the majors.

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The policy of restricting carriers to particular routes and of regulating fares,[1] frequency of flights and type of aircraft flown has either been abandoned or substantially relaxed. In the current regime, greater reliance is being placed on commercial incentives to determine flight characteristics and patterns. Federal regulatory attention has shifted to certifying ability to provide service; setting, monitoring and enforcing safety standards; providing certain airport facilities and establishing the terms of access to them.

Position papers, regulatory initiatives and legislation provide benchmarks in what was, and continues to be, an ongoing process of policy evolution. The important events, statements of intent and codifications of change in legislation include the pricing experiments initiated and monitored by the Air Traffic Committee of the Canadian Transport Commission in the late 1970s; the endorsement by the House of Commons Standing Committee on Transport of further regulatory liberalization in 1982; the announcement in 1984 of *The New Canadian Air Policy*, in which the Minister of Transport in the Liberal Government, Lloyd Axworthy, promised legislation to relax controls over routes and fares; the creation of the Canadian Aviation Safety Board in 1984; the release by the new Conservative Government in mid-1985 of the position paper, *Freedom to Move — a Framework for Transportation Reform*, and its review by the House of Commons Standing Committee on Transport;[2] and the passing of the *National Transportation Act, 1987*.

Experience under the new regime has confirmed some expectations and identified some areas of concern. As Soberman recently noted:

> The euphoria that followed deregulation of the Canadian airline industry (influenced to a great extent by the U.S. Airline Deregulation Act of 1978) has now given rise to serious concerns about increasing fares, reduced competition, safety, and poorer quality of service, as a result of consolidation of all airline service into two national networks and the disappearance of Wardair.[3]

There is concern that the consolidation of the system into two dominant commercial networks has increased private economic power at the same time that reforms have weakened the ability of the government to respond to that power. A number of questions are currently being posed. Will the forces leading to concentration leave Canada with only one major carrier? Is the mix of existing industry regulation and competition policy adequate to cope with the dominant duopoly or monopoly? Can domestic industry performance be made more effective by the development of an integrated North American or international regime for air travel? What are the implications of greater reliance on commercial incentives for the safety of the system? Can airport pricing and construction plans be developed to relieve congestion at airports? Can the system supply appropriate service to small communities?

This paper addresses an issue that cuts across a number of these questions — whether reinstating old or devising new regulatory measures to curb the exercise of market power is desirable.

## 2. THE PROBLEM

There are two aspects of single-carrier service that merit attention in the current policy environment. The first is whether the service is economically provided. Does the current commercial/regulatory system efficiently respond to the private demands of Canadian travellers? More specifically does it:

- encourage an appropriate choice of quality of service;
- minimize costs of providing that service;
- adequately discipline the pricing of the carrier; and
- realize timely introduction of new techniques and organizational reforms?

The second concern is whether collective demands, regional development, environmental goals and congestion alleviation are being economically served. In this study, we focus on the cost, quality and pricing aspects, and discuss dynamic aspects and collective responsiveness only to the extent that they interact with the former set of issues.

## 3. THE APPROACH

We begin by describing current regulatory controls over airline pricing and quality. We then report on Canadian price and quality experience from 1978 to date and selectively refer to American events. In the next section we discuss economic models, explaining pricing and quality decisions where more than one, but not a large number, of carriers serve the market. We then to consider the ability of potential competition to discipline the industry, as incumbents realize that entry will occur if market power is exercised. *A fortiori*, the contestability of the market is important when routes are supplied by only one carrier. The flip side of market contestability is the degree to which barriers to entry naturally exist or are created by incumbents.

After considering the influence of market forces, we shift to private and public institutional defences. We investigate the ability of private organizational responses and contracting to deal with inefficiencies arising from the pricing and quality decisions of a single or small number of suppliers. Government affects the efficacy of these private responses through contract law (which delimits the promises that are enforceable and defines private and public enforcement roles) and through competition policy (which further restricts the arrangements a business can effect). Governments also intervene directly into different transportation activities — bus, rail and trucking. Sector-specific regulation is tailored to the idiosyncrasies of the technology and the transacting environment of the industry.

Finally, we explore how sector-specific regulation of prices and quality has performed for other transportation modes available to travellers and assess the applicability of these techniques to the airline industry.

## 4. CURRENT ACCESS, RATE AND FARE CONTROLS

The *National Transportation Act, 1987* establishes two zones with different regulatory regimes, southern Canada and northern Canada.[4] Any flight beginning or terminating in the northern sector is governed by northern rules.

### SOUTHERN CANADA

Section 72(1) of the Act states that the National Transportation Agency "shall issue" a licence to any applicant who:

- is at least 75% Canadian owned;[5]
- holds a Transport Canada operating certificate; and

- has the prescribed liability insurance coverage.

Potential entrants are not required to demonstrate that their proposed service is required by "public convenience and necessity" as was the case before 1987.

Section 76 also states that a licensee must give the National Transportation Agency 120 days' notice before discontinuing or reducing to less than one flight per week any service the licensee has offered once a week or more for a period of six months or more. Agency permission to discontinue a service is not required.

With respect to fares, section 80(1) of the Act states that if, on receipt of a complaint in writing, the National Transportation Agency finds that there is no other alternative effective, adequate and competitive transportation service and that the carrier (licensee) has imposed an unreasonable basic fare increase, the Agency may either disallow the basic fare increase or reduce the increase in the basic fare by such amounts and for such periods as the Agency deems reasonable. Where practicable, the Agency may direct the licensee to make refunds to persons deemed by the Agency to have been overcharged as a result of the fare increase.

Section 80 does not apply to confidential contracts which carriers may enter into with various customers.

## NORTHERN CANADA

Section 72(2) of the *National Transportation Act, 1987* states that the Agency "shall issue" a licence to any applicant satisfying the three conditions required of entrants on southern routes (Canadian ownership, an operating certificate and liability insurance) *and* if the Agency is satisfied that the issuance of a licence would not lead to a significant decrease or instability in the level of service. The onus is on those objecting to new entry to demonstrate that it would jeopardize the quality of existing services (reverse onus test).

A licensee may discontinue or reduce the frequency of a northern service to less than once a week provided it gives 120 days' notice. As is the case with southern services, this applies to any service that has operated with a frequency of at least once a week for a period of six months or more.

Section 80(2) states that if, on receipt of a complaint in writing, the Agency finds that a carrier (licensee) has either an unreasonable basic fare *level* or has imposed an unreasonable basic fare increase it may disallow the basic fare *increase* or direct the licensee to reduce the level of, or increase in, the basic fare by such amounts and for such periods as the Agency deems reasonable. Where practicable, the Agency may direct the licensee to make refunds to persons deemed by the Agency to have been overcharged as a result of the basic fare level or increase.

## APPLICATION OF PROVISIONS

The annual reports of the National Transportation Agency refer to several investigations of air fares on northern routes. There have been no investigations regarding the reasonableness of fares on monopoly southern routes to date, that is, no section 80(1) investigations. There have been several investigations of fares on northern routes, that is, section 80(2) investigations. There have been two decisions under section 80(2), both relating to the reasonableness of fares between Winnipeg and Lynn Lake, Manitoba. Decision number 187-A-1990 stated that the fare complained of was a discount fare rather than an economy fare (a "basic fare") and was thus beyond the jurisdiction of the Agency. The other decision (number 133-A-1990) addressed the reasonableness of the increases in the basic fare between Winnipeg and Lynn Lake. It found the increase, which amounted to 100 percent over two years, to be "not unreasonable." The Agency gave the following reasons:

- The carrier (Calm Air) was in a loss position overall.
- The Winnipeg–Lynn Lake service also operated at a loss, and the losses had been increasing.

These increases were apparently the result of decreasing load factors due to the decline of the local economy and to improved road access.

The National Transportation Agency has conducted investigations of fares on other northern routes under both section 80(2) and section 59. Under section 59 the Agency can investigate whether or not rates charged for the carriage of goods by air, water, rail or pipeline are prejudicial to the public interest. Routes which have been investigated include Winnipeg–Gillam, Manitoba, Winnipeg–Oxford House, Manitoba, Yellowknife–Holman Island, Northwest Territories and Yellowknife–Coppermine, Northwest Territories.

The investigation of the Yellowknife routes provides some indication of the criteria the Agency is likely to employ in assessing the reasonableness of fares or the fairness of freight rates under sections 80 and 59 respectively. The criteria used in that investigation included:

- the overall profitability and rate of return on investment (long-term debt plus equity) of the carrier;
- the profitability of a "service" or related set of routes and the rates of return earned on them. (Profitability is revenue less direct cost less allocated indirect cost. Rate of return is profit divided by allocated investment);
- the profitability of individual routes (estimated as the basic fare times the average number of passengers plus estimated freight revenue per flight less direct and indirect operating costs per flight);
- comparison of fares over equivalent distances with equivalent equipment, load factors, service frequency and regularity; and
- accounting for the effect of infrastructure on costs. An example would be the restrictions imposed by short runways.

It appears that the Agency regards unreasonable air fares under section 80 and unfair freight rates under section 59 in much the same manner. A fare or rate on a route that is earning a normal rate of return is unlikely to be deemed prejudicial to the public interest.

While Agency decisions on and investigations of northern routes provide some guidance as to how the Agency might deal with monopoly southern routes, the latter are likely to be more complex. Both joint costs and revenues are likely to be more difficult to allocate to a particular route. Moreover, if there is a contestability problem, southern monopoly routes are going to be characterized by excess profits. Consequently, the concept of a normal rate of return will have to be more tightly defined for southern routes than on northern routes where rates of return appear to have been quite low. (An exception is Winnipeg–Gillam, Manitoba which, in the Agency's view, was yielding "a reasonable return on investment.")

# 5. PRICING AND QUALITY EXPERIENCE

This section provides background for assessing the adequacy of current rate and entry regulations and outlines what has transpired in Canada as commercial forces have been given more play.

In 1978, the Canadian Transport Commission sanctioned low-price experiments which were maintained until 1982. In this same period, all capacity constraints were removed from CP Air, advanced booking charters were allowed, and the major carriers began to develop feeder airlines. As a result, passengers on discount fares rose from 14.5 percent of traffic in 1978 to 37 percent in 1982. A sequence of new discriminatory pricing strategies was introduced by the scheduled carriers.[6]

## DISCOUNTING

Discriminatory fares can result in a more economical use of resources when there are economies of scale and/or fluctuations in demand. For this to be achieved, the differences between the rights acquired at different prices (called "fences" in the industry) have to separate the travelling population into two groups which together generate sufficiently high load factors and average revenues to make the flight remunerative. The intent of the different rates would obviously be frustrated if all travellers chose the low-price option. The target is to discriminate, provide service to the marginal traveller at the incremental cost, and cover average costs by "taxing" inframarginal purchases. Discrimination can occur along a number of dimensions: different rates by time of day, by amenities on the same flight, by time of booking, by length of stay, by characteristics of the passenger and by frequency or volume of purchases.

Airlines add to their fleets depending on the prospective return. Price discrimination affects the return realized on each plane and therefore influences investment decisions. For many routes, adding an additional plane represents a discrete and sizable change in capacity. Ignoring the often small marginal costs of adding another passenger to a flight, the situation is one in which public goods, from which a customer can be excluded unless a specified price is paid, are being provided competitively. There is controversy in the economic literature on whether such competition results in over provision or the correct provision.[7]

In reviewing the evidence generated by the pricing experiments, the Canadian Transport Commission concluded that discount fares with appropriate fences raised load factors and encouraged new business. Price differentials succeeded in generating more nighttime traffic, but were less effective in smoothing out demand cycles between seasons of the year. The experience during this period also revealed that amenity-related fences — baggage, meals, placing on aircraft — were less effective separating devices than trip-related fences — advance notice, length of stay, time of travel, number of stopovers.[8]

Charter traffic also responded to new opportunities and increased fivefold. In 1982, 9 percent of all domestic low-priced air traffic flew on charters. This niche was dominated by Wardair, which carried 76 percent of charter passengers in that year.

The experiments of this period were controlled and closely monitored initiatives. Subsequently, the carriers enjoyed even greater freedom to manage their load factors through discriminatory pricing initiatives. Alfred Kahn, an architect of airline deregulation in the United States, had predicted that "much of the [price] discrimination will tend to disappear"[9] with the relaxation of regulatory controls. In 1988, he reported his surprise at "[t]he persistence — indeed, intensification — of price discrimination."[10] Like their American counterparts, Canadian carriers took full advantage of the scope for discriminatory pricing.

Price structures have accordingly become more complex. Bailey and Williams provided the following American example:

> For example, in 1978 the tariff department at Delta had twenty-seven employees tracking competitors' fares and adjusting Delta's prices. By 1984 Delta's staff had grown to 147 employees monitoring 70,000 fares offered by Delta and its competitors, with the goal of optimizing some 5,000 price changes a day.[11]

Management has become more sophisticated at choosing the number of discounted fares to be offered per flight, their depth and the appropriate fences to maximize the revenue generated per flight. Alice Peung, the manager of AC's revenue enhancement programs claims that load management can raise a carrier's revenue by 4 percent.[12] Because of these practices, load factors have remained higher, *ceteris paribus*, than they were under more rigid pricing.

During the 1980s, the proportion of travellers flying on discount fares rose in Canada until it stabilized at a level of about two of every three travellers. Charter flights became less important on domestic routes as discount fares became more widely available.[13] Scheduled economy and business fares rose more rapidly than the consumer price index in the 1980s.

Although business class fares have risen relative to other fares, business travellers benefit from denser schedules and from frequent flyer programs. Of increasing importance is the ability of large businesses to negotiate confidential contracts with airlines for special fares. For obvious reasons, information about the extent of such contracts and their terms is fragmentary. There are occasional disclosures such as this 1985 account from an American business magazine:

> Last year, Delta Air Lines entered into a special deal with General Electric in which it guaranteed specific fare discounts in exchange for an up-front cash prepayment of $1 million as well as a guaranteed minimum volume of business. Some regional or business travel-oriented airlines have programs in place that give companies free tickets or credit toward future ticket purchases based on total sales volume.[14]

The availability of discounts and their average depth also varied by length of flight and by the regulatory regime governing air travel. For short-haul flights, high load factors are important in maintaining viability, as the following account of the challenges facing a small commuter airline attests:

> Financial success for a small independent regional airline like Skycraft, which flies 4,000 passengers a month, requires keeping the business loads up between 75 and 95 per cent and breaking into new markets where there is a lot of head-office-to-head-office travel.
>
> In Skycraft's case, that means moving General Motors of Canada Ltd. employees from Oshawa to Windsor and Detroit.[15]

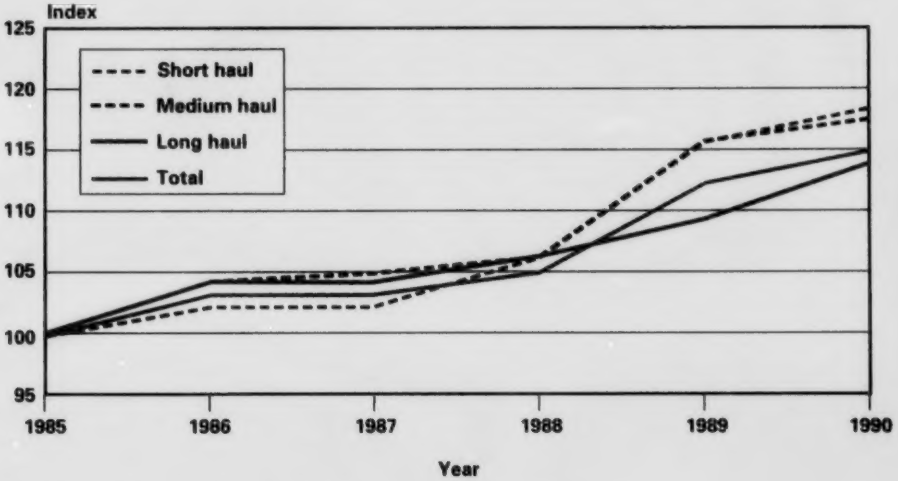
The scope for load management also depends on the stochastic flow and mix of customers with different reservation prices. Before deregulation, short-haul and less-travelled markets had lower load factors than average.

Despite the impact of low load factors on profit of short-haul routes, the relative number of seats available at discount are generally not as great on the short-haul flights offered by affiliates and independents.[16]

This reduced reliance on discounting indicates that discounting is a less effective instrument in generating higher loads for these routes. The difference in the pricing patterns by length of flight is reflected in the indices reported in Chart 1 for economy fares and in Chart 2 for discount fares.

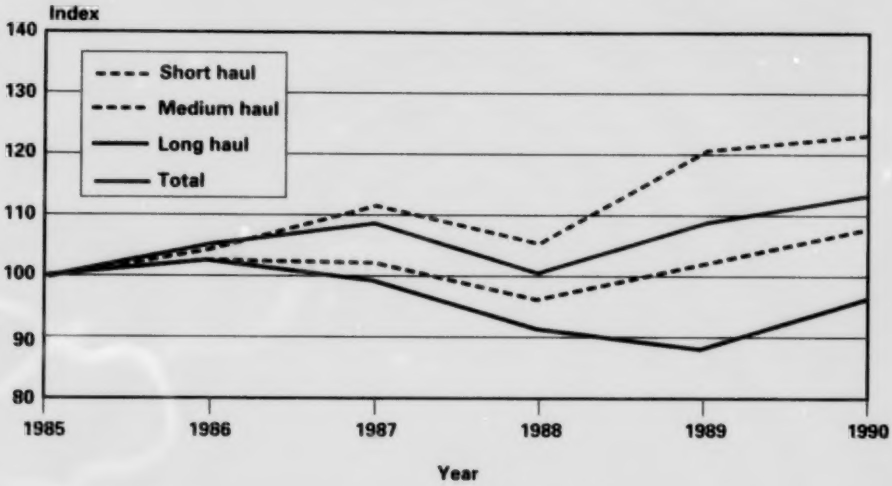
Statistics Canada reports that economy fares and discount fares grew less quickly in the more tightly controlled North than in the South from the fourth quarter of 1986 through to the fourth quarter of 1989.[17] On the other hand, the level of discounts and their availability are lower in the North. The differences in economy and discount fare indices between the South and the North for the first quarter of the period 1985 to 1990 are graphed in Chart 3.

*Chart 1*
*FIRST QUARTER AIR FARE INDICES*
*ECONOMY FARES BY LENGTH OF HAUL*



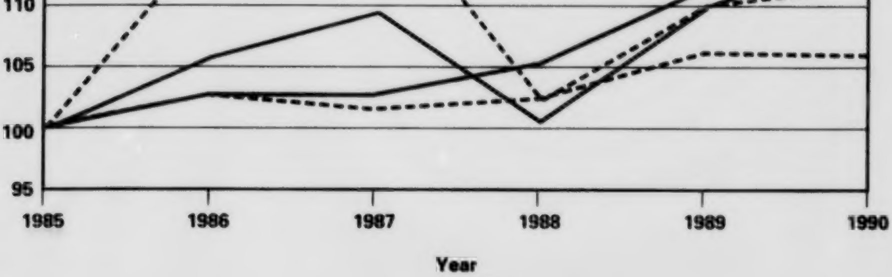
**Source: Transport Canada, *Aviation Industry Review*, 1990, p. 35.**

### Chart 2
### FIRST QUARTER AIR FARE INDICES
### DISCOUNT FARES BY LENGTH OF HAUL



Source: Transport Canada, *Aviation Industry Review*, 1990, p. 35.

### Chart 3
### FIRST QUARTER AIR FARE INDICES
### ECONOMY AND DISCOUNT FARES, NORTH/TOTAL



Source: Transport Canada, *Aviation Industry Review*, 1990, p. 36.

## FREQUENT FLYER PROGRAMS

American Airlines introduced frequent flyer programs in 1981, and this volume discount scheme has become standard industry practice. According to one recent American survey, 72 percent of business travellers and 23 percent of leisure travellers now participate in at least one such program.[18]

The plans were introduced into Canada in 1984. Most of the members of the Canadian Commercial Flyers Association belong to two frequent flyer programs.[19] A special appeal of affiliation with AC or CAIL is the right to participate in a program which can offer better and more varied rewards. Frequent flyer programs have been singled out by some analysts as a potentially potent barrier to entry.

## TRAVEL AGENTS AND PRICES

A traveller commits a substantial amount of money and time to a plane trip. For the infrequent traveller much uncertainty and ignorance exist concerning the qualities and prices of service available. Travel agents represent an important instrument for overcoming the informational problems facing air travellers. Under the current price regime, the number of agencies and the percent of bookings done by agents have grown rapidly. As drug manufacturers often address their marketing efforts primarily to doctors, airlines focus on travel agents. In the United States, 81 percent of tickets on scheduled carriers were sold through travel agents in 1988. This compares to 56 percent before deregulation. At the same time, the number of agency locations rose from 14,800 in 1978 to 29,600 in 1987.[20] Customers' anticipation that information of benefit to them but not to the travel agent will be withheld grows as the fare structure becomes more complex and more tickets are sold through agencies. This problem has many dimensions and exists because of the commercial incentives for agents. Recent criticism has focussed on contracts between agents and airlines that provide for override commissions, premiums paid based on the volume of business transacted by the agent for the airline. Evidence is unavailable in Canada, but in the United States the importance of override commissions has increased dramatically. In 1986 over half of the travel agents surveyed received such commissions. Since it is estimated that travel agents are influential in dictating the choice of carrier in over one half of the non-business ticket and one quarter of the business ticket sales, there is concern that agents will not direct the purchaser to the cheapest source but to the source from which they will receive the highest remuneration.

Large customers may generate sufficient business to warrant hiring services that audit their travel decisions and determine whether they have received good service or not.[21] However, this defence is uneconomical for individual consumers who must rely on experience and the agent's reputation for probity. Competition among agents to create such a reputation may result in some agents voluntarily publicizing the general nature of their relations with airlines. Although a disclosure requirement might be helpful, the costs of consumer monitoring could be lowered by having travel schedule information more readily available. Ideally the information could be distributed over cable or telephone services such as the experimental "Alex" offering of Bell Canada. Terminals at libraries could extend the reach of the information. The *National Transportation Act, 1987,* section 83(1), requires that airlines make fare schedules available at their business offices, and a copy has to be made available to a customer on request at cost. The availability of discounts and their amounts and conditions change very quickly. A printed schedule distributed to a customer carries both irrelevant and outdated information.

## COMPUTER RESERVATION SYSTEMS

Agents depend increasingly on computer reservation systems (CRS) to provide marketing information and travel services to their clientele. The potential ability of a CRS provider to bias this information for anti-competitive purposes has been a source of public concern. Court decisions and complaints to regulators[22] prompted the promulgation of rules to govern the provision of CRSs in the United States. Display bias, pricing, contract length, terms and conditions of contracts and non-discriminatory access to enhancements such as direct access links are governed by the rules. In Canada the Competition Tribunal recently imposed a set of similar rules and constraints as a condition for its approval of the merger between the computer reservation systems of AC and CAIL.

## OVERALL CANADIAN PRICE PERFORMANCE

The existence and importance of discount fares and the shift by the major carriers toward providing long-haul flights were contributing factors in making the revenue per passenger-kilometre for major Canadian airlines grow at a much lower rate than the general price level. In the previous price structure, above-cost rates on long-haul flights cross subsidized rates on short-haul flights. As networks realigned in response to greater freedom of entry, exit and pricing, commercial pressures resulted in the fall of long-haul relative to short-haul rates. A further factor that reduced fares was the squeezing of economic rents earned by workers in the industry under the previous regulatory regime.

This process is well documented for the United States. Before deregulation, American labour relations in the airline industry were governed by the *Railway Labor Act,* which encouraged organization according to craft or class. Consequently, a fragmented bargaining environment had evolved. Thirty-four different unions had members in the American airline industry, many of which could halt activity at an airline. In 1958, the carriers responded by organizing the Mutual Aid Pact which provided for compensation of member carriers by other members for losses resulting from a strike.

Despite employer organization, wage rates in the industry were substantially higher than those for comparable jobs in other sectors, and many restrictive labour practices were adopted. For example, United's labour contract required it to fly its Boeing 737s with three flight crew members while Piedmont and Southwest flew with two. Thornicroft reported that: "By 1980, many pilots were flying only 44.3 hours per month, despite guaranteed payment for 75 hours per month and FAA regulations that permitted pilots to fly 100 hours per month."[23]

The differences between the union wages under regulation and the market wages for similar skill levels were substantial. Moore noted that: "Nonunion pilots earn as little as $32,500 per year for flying a Boeing 737, compared to the $102,000 salary that United Airlines pays one individual to pilot a similar craft."[24]

Labour represents the industry's largest operating expense. Between 1978 and 1986, 14 of the new entrants in the United States were non-unionized. Generally, these companies had fewer senior personnel, operated under less restrictive work rules and hired more part-time workers to meet peak demands. Labour costs were consequently much lower for the new entrants.

> For example, in 1984 USAir's average pay and benefit package per employee was $47,896, while that of People Express was $17,139, providing People Express with a significant cost advantage. Similarly, when Continental underwent bankruptcy and was able to replace its unionized labor force with nonunion workers, its pay and benefit package was reduced from $36,875 (per employee) in the first quarter of 1984 to $23,433 by the fourth quarter of that year.[25]

Many of the unionized airlines threatened to create non-unionized affiliated carriers, and some did. For example, Texas Air and Frontier Airlines formed New York Air and Frontier Horizons. Litigation and strike activity increased. In 1979, 4,075 person-years were lost, and 24,968 employees were involved in strikes in the United States.[26] The intensity of labour confrontation abated in the early 1980s. Two-tier labour contracts and beneficial changes in work rules were introduced. Under the two-tier contracts, new employees were paid considerably less than existing ones. For example, at American new pilots started at 50 percent of the old pay scale. Most of the two-tier contracts called for the merging of the two tiers within a prescribed period of time. By 1990, the labour cost differences of the immediate post-deregulation period had narrowed considerably.

Similar but less dramatic effects occurred in Canada with a time lag. Both major carriers have pared their workforces. In December of 1989, CAIL announced the elimination of 1,900 jobs of which 1,017 were former Wardair jobs.[27] In October of the following year, Air Canada cut 2,900 jobs[28] and CAIL announced further layoffs and schedule retrenchments.[29]

Overall price performance is difficult to assess because the number of different types of flights and the multitude of rates on any one flight result in particularly wicked index number problems. Nevertheless, analysts familiar with the industry make general statements about price performance. For the most part, they agree that there was a substantial fall in average prices during the transition period to the new regime. The following statement by Bence is representative:

> In 1985, 64 per cent of passengers travelled in Canada at reduced rates, the average reduction in relation to the base rate being over 50 per cent. Since each level of reduction is subject to a varying

> number of restrictions (advance bookings, length of stay), this means that a much wider choice of rate/service combinations were available to passengers.[30]

Price performance has not been as impressive recently, and there is concern that without the stimulus of new entry, with less scope to squeeze factor rents and a higher degree of concentration, future performance will not match that of the past.

## AMERICAN PRICING EXPERIENCE

The United States has experienced similar but not identical price patterns. Prices and the proportion of travellers enjoying discount rates appear to be more volatile in the United States than in Canada. In some years, the proportion of Americans travelling on discount fares has been considerably higher than in Canada. For example, Kahn notes that "90 percent of all passengers in 1986 travelled on discount tickets, at an average 61 percent below coach fare."[31] The percent in Southern Canada was just below 60 percent.[32] In the United States, price competition was vigorous in 1986, and financial performance was dismal.

Meyer and Oster provided the following overall summary of American experience:

> Deregulation's effect on fares has varied with the type of ticket and the size of the market. First-class fares are relatively higher in most markets, although increases generally have been small (on the order of 2 percent). Unrestricted coach fares have decreased slightly in the largest and most dense markets, while average coach fares in medium and small markets have risen about 3 and 6 percent, respectively. More important, since deregulation discount fares have become available in over 80 percent of all markets, and well over 60 percent of all passengers were flying on discount fares by 1984, with these discounts ranging upward to 50 percent or more. Prior to 1976 discount fares were rarely available outside the largest markets and were seldom deeper than a 20 percent reduction. Discounting also has increased pressures to reduce standard coach fares in the largest markets.[33]

As in Canada, recent price performance has not been as impressive as in the transition period.

## PRICES AND NUMBER OF CARRIERS

Statistical exploration of the American evidence of the connection between the number of suppliers and the exercise of market power in pricing, indicates that fewer suppliers mean higher prices. The studies differ in quantifying the effect of actual competition and in assessing the impact of each additional competitor. For example, Moore reported:

> The evidence is impressive: those markets served by only one or two carriers experienced price jumps of over 40 percent in real terms, while those markets served by five or more carriers enjoyed fare increases of less than 3 percent. The ratio of fares does decline slightly from one to four, but the big drop is with the five-or-more-carrier market.[34]

Morrison and Winston, working with a different period and specifications, concluded that if suppliers fell from two carriers to one, an "average round-trip fare on the route would increase about 9 cents a mile, or $89 when evaluated at the mean sample distance of 983 miles."[35] In contrast to Moore, they found that moving from three to two competitors had much less effect and the bulk of the benefits derived from having multiple suppliers is realized by a duopoly.

## NETWORK RECONFIGURATIONS, AFFILIATES AND INDEPENDENTS

As well as changes in fare levels and structures, there were important changes in the many dimensions of service — frequency of flights, reliability of scheduled information, air time, ground time, baggage service, ticketing, registration, waiting room comfort and convenience, and flight amenities — which affect the quality of air travel. Under the more permissive environment, mergers and alliances have resulted in larger organizations coordinating equipment, standards and flights. The resulting networks provide a different quality of service than formerly.

A characteristic of the new network is the hub-and-spoke configuration. Flights are scheduled to reach and leave a hub airport during a common period of the day so passengers originating at different centres can be pooled to proceed to other destinations.[36] However, some passengers may be worse off if an indirect flight through a hub replaces a direct connection. In the United States, the large airlines have a number of main hubs and regional hubs. Delta, for example, has four anchors (Atlanta, Cincinnati, Dallas and Salt Lake City) and four corner posts or supplemental hubs (Boston, Los Angeles, Orlando and Portland).[37] In Canada, which has a belt rather than a grid as a geographic market, the economies realized from a hub-and-spoke configuration are less than in the United States. Nevertheless substantial realignments have occurred. Toronto has become a major hub,[38] and Montreal and Vancouver are regional ones. Unlike the United States, there are few connections in Canada which would be competitively served by more than one hub-and-spoke system, that is, two systems connecting destinations through a different hub.

As flight patterns were being realigned, AC and CAIL concentrated on the longer flights on dense routes and established feeder affiliates either directly or through acquisition or contract. Affiliation agreements typically coordinate timetables and integrate the local airline into the baggage, reservation and frequent flyer systems of the major carrier. The structure of the affiliate groupings frequently changes. The components of the AC and CAIL families in 1989 are presented in tables 1 and 2. The general strategy of AC is to control its affiliates while CAIL typically owns less than 50 percent of its partner companies.

*Table 1*
AIR CANADA CONNECTORS

| Carrier | Linkage | Fleet |
|---|---|---|
| Air Nova | AC owns 49% | 4 jets, 9 non-jets |
| Air Alliance | AC owns 75% | 9 non-jets |
| Air Ontario | AC owns 75% | 17 non-jets |
| Air Toronto | Code sharing,<br>AC agreement to purchase | 10 non-jets |
| Air BC | AC owns 85% | 5 jets, 26 non-jets |
| NWT Air | AC owns 90% | 2 jets, 6 non-jets |

*Table 2*
*CAIL CONNECTORS (CANADIAN PARTNERS)*

| Carrier | Linkage | Fleet |
|---|---|---|
| Canadian North | Division of CAIL | 8 jets |
| Air Atlantic | CAIL owns 45% | 15 non-jets |
| Ontario Express | CAIL owns 49% | 19 non-jets |
| Frontier Air | Ontario Express owns 100% | 11 non-jets |
| Calm Air | CAIL owns 45% | 15 non-jets |
| Time Air | CAIL owns 46% | 3 jets, 28 non-jets |

The affiliates fly smaller aircraft and serve commuter traffic as well as providing connector flights.

In addition to the affiliates, independents and small commuter airlines provide scheduled service. In 1987 there were 103 such carriers. Another 634 offered commuter charter service.[39] Many of the new independent entrants have not survived, despite success in their early years. In 1985 the President of City Express stated:

> City Express either would not exist or would have taken years to reach the point we are at today had it not been for this new Canadian Air Policy. It gave us the chance to (achieve) flexibility in pricing and the ability to have a simple fare structure with no confining conditions of sale. The skies are opening up at last.[40]

By July 1990, the company was in financial difficulty with four of its Dash 8 aircraft seized by Mutual Life of Canada. Formal bankruptcy followed. Wardair, another early enthusiast for and beneficiary of deregulation, ran into financial difficulties and was taken over by CAIL in early 1989. With Wardair's departure, Intair, a former partner in the CAIL system, became the largest independent. Intair challenged AC and CAIL on the dense Montreal–Toronto–Ottawa axis. By March of 1991, Intair was in financial difficulties and was reported to be negotiating to return to the CAIL fold.

## SCALE AND NETWORK ECONOMIES

The misplaced enthusiasm of the executives of Wardair and City Express over the opportunities created by deregulation was reflected by academic opinion which generally underestimated the significance of scale and network economies in air travel. For example, Gillen, Oum and Tretheway claimed:

> A small network carrier should not have a *cost* disadvantage, provided it achieves traffic densities within its small network similar to those of Air Canada and CAI. Two independent carriers for whom data was not available, Wardair and City Express, appear to be attempting to build such small, but high density, networks in scheduled markets.[41]

By the date of publication of their article, Wardair had disappeared, and City Express was a few months away from bankruptcy.

Caves, Christensen and Tretheway introduced a distinction between economies of density and scale.[42] Earlier empirical work had shown substantial unexploited system scale economies for the U.S. local airlines. This seemed to be confirmed by the higher unit costs experienced by the local carriers. Caves et al. were persuaded to make the distinction by the paradox that despite these cost differences the local airlines were competing effectively with the trunk carriers and gaining market share from them. Their study covers American airlines between 1970 and 1981. The Gillen, Oum and Tretheway study adopted similar categories and distinctions in analyzing the Canadian data from 1964 to 1981.

Caves et al. distinguished between the size of the networks and the transportation services provided within them. Output was captured by four variables: volume of services provided, load factors, average stage length and a network variable. Economies of scale occur if the increase in total costs is less than proportional when an increase in the size of the network and services provided takes place (keeping load factor and average stage length constant). Density economies occur if unit costs fall with an increase in services within a network of a given size (keeping load and stage length the same). The size of a network is measured by the number of points served. For example, a network linking Toronto, Hamilton and St. Catharines would be the same size as one linking London, Toronto and Los Angeles. Average stage length catches the effects of distance between points in the network. Gillen et al. used a hedonic measure of output and a similar separate measure for the network effect.

Caves et al. identified the scale elasticity as 1.07. As a result, they did not reject the notion that the "true" value is 1.00 and then concluded that there are no economies of scale. In this context, there is no reason to maintain constant returns-to-scale as a null hypothesis. It would be more instructive to report a confidence interval for the scale measure. In any case, the most likely value of returns-to-scale is 1.07. Larger American airlines would then be expected to have lower costs. In comparison, for Canada, Gillen et al. found that the best estimate of returns-to-scale for 1980 was 0.881 for Air Canada and 0.96 for CP Air. Based on their variable cost function estimate, an overall returns-to-scale of 0.992 was reported, indicating that larger-scale airlines face a cost disadvantage in Canada.

William Jordan came to the same conclusion with respect to the importance of scale and density. In an article contrasting American and Canadian events during the period 1978 and 1984, when American regulation was more relaxed than Canadian, he noted:

> This clear contrast between the Canadian and U.S. experience provides unambiguous evidence that one effect of deregulation has been to increase both the number of jet airlines entering the industry and the number in existence at any point in time.[43]

The gap between the econometrically measured scale effects in Canada and the commercial lack of success of small carriers may be due to the difficulties of uncovering the details of an industry's cost relations from the data available with even the most sophisticated of econometric analyses. Gillen, Oum and Tretheway used the number of points served by an airline as a proxy for its degree of networking. However, the data for their analysis cover the period from 1964 to 1981 when routes, frequency of flight and type of aircraft flown were regulated in Canada. The authors faced the difficult task of inferring the degree of network economies from a crude proxy and data generated by a situation in which the companies were constrained in choosing route structures. The subsequent restructuring in Canada and the American experience suggest that the regulatory constraint was binding. Graham and Kaplan noted that in the United States the Civil Aviation Board "often retarded the development of a highly integrated route network."[44]

Based on the Canadian evidence from this earlier period, one might conclude that any airline could add service between a particular city-pair at a similar or lower cost, regardless of the exact configuration of its existing network and where it was located in relation to the city-pair under consideration. Indeed the smaller the airline the more effective service it would be able to offer.

This inference is doubtful. Sometimes demand characteristics, which outweigh the identified cost conditions, are posited as the reason for the advantages of size. This claim can be confusing.[45] If passengers are willing to pay more to deal with a large established airline, presumably it is because they anticipate more or better outputs such as baggage handling, availability of alternatives, care and information with respect to delays and security of service. These services are part of an airline's output. Their exclusion in output measures in the econometric studies represents a specification error.

The paradox of successful competition from the local airlines with the trunks, mentioned by Caves et al., and the crowded field of contesting carriers, observed by Jordan, was a temporary phenomenon. The present situation could not be described as one in which local airlines were competing effectively with the trunk carriers and gaining market share. Bankruptcy and merger have been more frequent experiences than expanding market shares.[46] Given the ubiquitous consolidation trend we suspect that cost economies are playing some role in the process, despite the econometric evidence to the contrary. Canadian analysts were not alone in underestimating the importance of scale in providing network airline service. In his candid admissions of what he had not anticipated about American deregulation, Alfred Kahn confessed in 1988 that:

> We advocates of deregulation were misled by the apparent lack of evidence of economies of scale — the principal explanation of the differences in cost among the carriers appeared to be differences in their route structures, which we hoped to eliminate by permitting totally free entry and exit — and by the physical mobility of aircraft, which caused us to underestimate the other obstacles to entry.[47]

## CONGESTION AND ACCESS TO AIRPORTS

The schedules which take advantage of hub-and-spoke configurations have accentuated the traditional concentration of flights at peak travel times and shifted patterns of travel. As a result, congestion has occurred at some airports. In the United States, events associated with the 1981 air traffic controllers strike made this problem more acute by reducing the number of flights that could be handled at airports.[48] A number of American airports adopted rationing systems during the early 1980s; today four major American airports[49] still have a slot control system in place.

Toronto and Vancouver airports have also experienced congestion. Toronto's Pearson airport experienced extensive delays and cancellations at the end of 1988.[50] The director of airport terminals at Pearson, Jim Mattick, stated: "I have pictures from Christmas [of 1988] showing 37 aircraft lined up for take-off. There were ground delays of 180 to 200 minutes."[51]

As a result, Pearson introduced a slot allocation system administered by committees of airport, airline and federal representatives. These committees consider international flight commitments, gate assignments, customs and immigration requirements and security arrangements in making their decisions.

In the United States, the carrier committees were originally granted antitrust immunity with respect to their allocation of slots. As a result of concern within the Federal Aviation Administration (FAA) that the committees were biased against new entrants, a more market-oriented system was introduced in 1985. A block of slots at the four constrained airports were assigned to incumbents, who could then buy or sell them.[52] The FAA can take a slot away from a carrier, and there is a "use it or lose it"[53] provision. Within those slots allocated to carriers, a subset are designated for international use. Transfer of these international slots is further restricted.

A new entrant can purchase or lease a slot from a current holder or acquire one through the lottery used to allocate new slots and those returned under the "use it or lose it" rule. Estimates of the value of a slot vary from US$800,000 to US$2,000,000.[54] The slot market is not characterized by the law of one price. In 1990, Secretary of Transportation Skinner's task force reported: "The slot holder must be concerned about the uses to which another operator will put the slots, regardless of whether the potential buyer is a new entrant to the specific slot market or an existing carrier in that market."[55]

America West has complained that carriers selling slots have not notified all potential buyers of the availability of the slot. It cites a sale by Alaska Airlines of a slot at O'Hare to United as a case in point.[56]

The Americans have favoured entrants or small incumbents in allocating new and returned slots. In 1980 the Secretary of Transportation ordered that 28 slots at Washington National be given to five new carriers. More recently, 25 percent of new and returned slots allocated by lottery have been reserved for new carriers. Windfall gains have accrued to new carriers which in many cases have not used the slots in their own operations, but have sold them. Of the 145 slots made available to new entrants or to limited incumbents (those with less than eight slots) only 15 were in use by the carriers that first received them. Some slots were returned to the FAA without use, but the majority of them were sold or transferred in a merger.[57] In Canada, there are no special provisions for new entrants. Recently, Intair had what the National Transportation Agency of Canada termed a "well-publicized skirmish with Canadian Airlines over landing-slots at Pearson International."[58]

As well as access to the runway, an airline requires rights to gates, waiting room space, ticket counters, airplane service facilities and luggage pickup areas. In the past, American airport ownership patterns and financing arrangements have been more varied than in Canada where major airports have been largely owned, financed and operated by the federal government. Recently, Canadian policy has encouraged more private participation in financing airport expansion and the transfer of ownership of existing facilities to local interests. Reaching agreement with local interests affected by the expansion of airports and the development of new runways and air traffic control techniques has been difficult in both Canada and the United States. Sometimes incumbent airlines have been covert partners with affected residents in delaying measures to address airport congestion.

Prices for slots, terminal space and other airport facilities provide information about scarcity and aid in making informed investment decisions. Private ownership of the rights encourages the evolution of pricing schemes that reflect the time-of-day patterns of scarcity. Rental prices charged by a private owner for use at prescribed times would reflect the value realized by the user. More crudely, airlines could adjust their positions by swapping access rights under their control. With public ownership, the authority could charge time-of-day user-costs to carriers. The gains from obtaining better information and coordination are substantial. Morrison and Winston estimated that optimal airport pricing and investment would generate benefits of $11.0 billion in the United States.[59]

Adoption of such measures has been slowed by the political opposition of those adversely affected. As it has with privatization schemes, distributing the private rights judiciously among those affected may broaden the base of support, as the recipients gain a valuable resource. As well as encouraging privatization of airports, Transport Canada has announced a target of having users finance the airport services it provides. Charges for landing, terminal use, aircraft parking and fuel have been raised, and plans to introduce general terminal fees at airports have been announced. Understandably, the industry does not welcome paying for scarce resources it was previously receiving on concessionary terms. The Air Transport Association of Canada's chief executive officer claimed that a full recovery of costs by Transport Canada on regional service will mean an additional $300 million charge.[60]

## FLIGHT QUALITY

When flights are switched from a major carrier to one of its affiliates or an independent, jet service is frequently replaced by propeller-driven service and smaller aircraft. Comfort generally decreases while scheduled frequency and duration of flight increase. Some additional direct flights are introduced, and some existing ones are replaced by connections through a hub. In other cases, indirect routing through a hub provides a competitive alternative to the direct flight. For example, Air Toronto provides city-to-city service on 152 flights per week from Toronto to eight eastern US destinations. This Air Canada affiliate does not fly into major American airports. A traveller could fly directly between Toronto and Indianapolis on a propeller-driven plane or fly there by jet, transferring in Chicago.

How all these changes affect the quality of air travel on shorter flights depends on the traveller and the travel itinerary. The National Transportation Agency, the industry overseer, views the net effect on quality as positive:

> When the major airlines withdraw from a market, the community usually receives improved air service in the form of increased direct flights and available seats from the regional affiliates. In some cases, competing air service is provided by independent carriers. Also, while the replacement services are usually provided with non-jet aircraft, some markets continue to receive jet service.[61]

On longer domestic flights, Wardair provided a different class of cabin and ancillary service than that offered by the traditional companies. Similarly, in the United States, a broad range of service qualities was offered during the early years following deregulation. At the low end of the market, People Express unbundled the pricing of different cabin services and provided many innovations in vying to become the McDonald's of the industry, as the following tribute from Moore described:

> Started in April 1981 with three used Boeing 737s flying from its Newark hub to Buffalo, Columbus and Norfolk, People Express has grown in three years to serve twenty-two cities with forty-six planes and to employ over 2,300 people. Originally, it served only smaller cities in the East Coast area; recently, its network has expanded to include Houston, West Palm Beach, London, Los Angeles, Chicago, Minneapolis, and Oakland, where it offers the lowest-cost service available. Its success is based on offering low-cost air travel while requiring passengers to pay for all additional service. Thus if a passenger checks luggage, it costs $3.00 per bag. Coffee and soft drinks are sold for fifty cents. Passengers pay for their flights after boarding the aircraft. No hot food is served on any flights, including the ones to London; even the premium-class passengers must pay for their meals. However, People's fares are the lowest to be found.[62]

By the time Moore's article was published in 1986, People Express had gone bankrupt. The cabin and ancillary service options offered on long-haul flights today look remarkably like those that were in existence before deregulation and do not appear to be markedly more varied. The innovations of the deregulation period that pass the survivor test are hub-and-spoke networking and load management.

## CHARTERS IN THE NEW SYSTEM

In Canada, a number of jet charter carriers have also entered the industry offering an alternative service to scheduled international flights. Recently, however, the exit of charter carriers has been more frequent than the entry. Of the 11 jet charter companies offering flights at the end of 1988, seven have disappeared. In 1989, Holidair and Minerve ceased operation and, in 1990, the exodus accelerated with the financial grounding of Vacationair, Points of Call, Crownair, Odyssey International and Worldways. Consumers have suffered inconvenience and sometimes financial losses from these failures. As Oum et al. noted:

> The recent bankruptcies of several Canadian charter airlines has resulted in substantial losses to consumers as their prepaid tickets were not protected in trust funds. To some extent this is a failure of enforcement rather than policy, although the existing law leaves it to provinces to set policies and many of them have not.[63]

Ontario is one province with consumer protection legislation. However, the Ontario travel industry compensation fund does not become operative unless a tour operator has gone bankrupt, and therefore does not offer relief in situations like the Worldways collapse which affected over 8,000 passengers. Many received assistance through tour operators such as Carousel Holidays, Fiesta Holidays and Conquest Holidays, which contracted with the remaining charter companies to supply replacement seats.[64]

## SCHEDULED FLIGHT FREQUENCY

Travellers have more flexibility in planning and adjusting to unforeseen events when there are more flight offerings. Under the new regulatory regime, the frequency of flights in North America increased significantly. In Canada the number of cities linked by flights rose by almost 60 percent between 1983 and 1989.[65] In addition, capacity on major city-pairs has risen markedly.[66] Although we are prepared to attribute this rise to the greater pricing, exit and entry freedom, the relation may not be strictly monotonic. While both the South and the North of Canada operate under more flexible regimes than before, there are more controls in the North. Between 1984 and 1989 departure frequency almost doubled in the South but grew even faster in the North.[67] In the United States, traffic increased since deregulation by 50 percent (passengers) and 27 percent (departures) according to the Federal Trade Commission.[68]

## CARRIER COMPETITION

The National Transportation Agency publishes and interprets much useful data in its annual reviews. With respect to the degree of actual competition on Canadian routes, it noted that for 1989:

> Among the top 146 domestic city-pairs, which account for almost 90 per cent of passenger traffic in Canada, the proportion served by two or more competing carriers rose from 44 per cent to 77 per cent between 1983 and 1989 . . . [and] . . . Among the top 42 communities in the network, where about 95 per cent of domestic passengers originate or terminate their travel, all had at least two scheduled carriers in 1989 while one-half of them were served by five or more airlines.[69]

The accompanying exhibits indicate that among the top 146 city-pairs the proportion served by one or no carrier has fallen from over 50 to about 20 percent. The Agency has maintained in both its annual reports that there is no lack of competition in Canadian air service. In 1988 it stated:

> Any appearance of diminishing competition in this situation is misleading. There is extensive duplication of route coverage between the Air Canada and Canadian networks, and regional affiliates face an increasing number of small commuter carriers as well as each other in the scramble for local or feeder traffic.[70]

In its 1989 review the Agency commented:

> Canada's airline industry has always been concentrated, but when examined closely, be it in terms of passengers carried, passenger-kilometres, arriving/departing flights, seats offered etc., it is less dominated by one airline now than it was before the relaxing of regulatory controls in 1984.[71]

Judging the effectiveness of competition is not an exact science. Although aspects of what is occurring support the Agency's conclusion, there are reasons for concern. First, after an initial period of entry the trend has been to consolidation. Some analysts feel that trend has not run its course, and in the future there will be one airline aligned by strategic alliances with foreign megacarriers. Bence provides a clear outline of this script:

> First of all, the privatization of Air Canada lifts the political obstacles to a merger with Canadian International. In addition, the two carriers recently stepped up their cooperation in the area of computerized reservation systems through the joint creation of the Gemini system. . . . The second remark relates to the liberalization of trade with

> the United States. Despite much reluctance and resistance, it is very probable that the total or partial creation of a North American air transport market is only a matter of time. . . . For some months, there has been a multiplication of commercial agreements between companies of different countries. Canada has not remained inactive in this area and Air Canada, for example, has concluded agreements with Air India and Singapore Airlines International. A new step toward the internationalization of the industry seems to have taken place recently with the exchange of assets between companies. In this regard, information has been circulating in the industry concerning a possible agreement between Canadian and Cathay Pacific Airways. The last phase of this evolution would be the creation of large multinational groups active on several continents.[72]

Second, American evidence indicates that the demand price of a traveller is higher for a ticket with a carrier which offers more frequent flights on a route. The carrier with more frequent service experiences higher loads and can charge a higher price.[73] A small number of flights offered by other carriers may not exert substantive pressure on the pricing of the carrier offering concentrated service on the route. In documenting the existence of the relationship, Borenstein illustrated its strategic importance by quoting from a 1985 internal memo from an executive Vice-President to the President of USAir:

> There is still much to do before we can be confident that we have established a northeast stronghold that is as impervious as possible. Ideally we should control a major portion of the traffic at each of the cities in the north east. The beauty of the niche strategy is not just the marketing identity and control that it gives us. In addition, it enables us to keep control of prices within our niche territory, thus insulating a significant portion of our traffic from the devastating effects of unbridled price competition.[74]

Third, the amount of effective competition generated when a small number of carriers serves a route is moot. Will the competitors collude implicitly or explicitly, or will competition be intense? In the United States there has been concern with the rising concentration even though there is more overlap between different systems, and geography increases the number of alternative means of getting from one destination to another. Alfred Kahn, for example, is not only concerned about the current level of concentration in the United States, but blames lax antitrust enforcement for the situation.

> The concentration process reflected also what many of the advocates of deregulation would characterize as a lamentable failure of the administration to enforce the policies of the antitrust laws — to disallow a single merger or to press for divestiture of the computerized reservation systems or attack a single case of predation.[75]

## PROFITS

If concentration is a problem it should manifest itself either in increased profitability or in a costly dissipation of potential profits. The evidence fails to indicate that providing air service has become more profitable under the new regime either in the United States or in Canada. Nor is it evident that potential monopoly profits exist and are being masked or dissipated through slackness or some other avenue.

For the United States, Cunningham et al. summarized the evidence:

> There have been a variety of studies of the profitability of the airline industry during its transition from regulation to deregulation. It is clear from these studies that most measures of profitability of the airline industry that are based on historical accounting returns have not improved since deregulation.[76]

At first, the performance of the stock of new and old airlines in the United States reflected the optimism of many of the new entrants in the industry.[77] Since then the stock values of the established carriers has been mixed while that of the many entrants have either been bought out or have become worthless through bankruptcy. In 1989, four American airlines made profits of US$1.6 billion while the five other major companies made a loss of US$1.59 billion. The successful companies were American, Delta, United and Northwest. The only new entrant to survive, Midway, was then reported to be "low on cash and rumoured to be a merger candidate."[78] Since 1989, Midway has declared bankruptcy.

One concern of opponents of deregulation was that competition would be destructive, and carriers would not generate the profits that had been experienced with regulation and which were necessary for financing capital acquisitions.[79] Van Scyoc addressed that issue and concluded that:

> It was not deregulation of airlines which adversely affected profits but, rather, the sluggish economy and rapidly rising fuel cost along with higher real interest rates. Deregulation has allowed the airlines to increase their average load factor (ALF), keeping their profits from falling even lower than they have.[80]

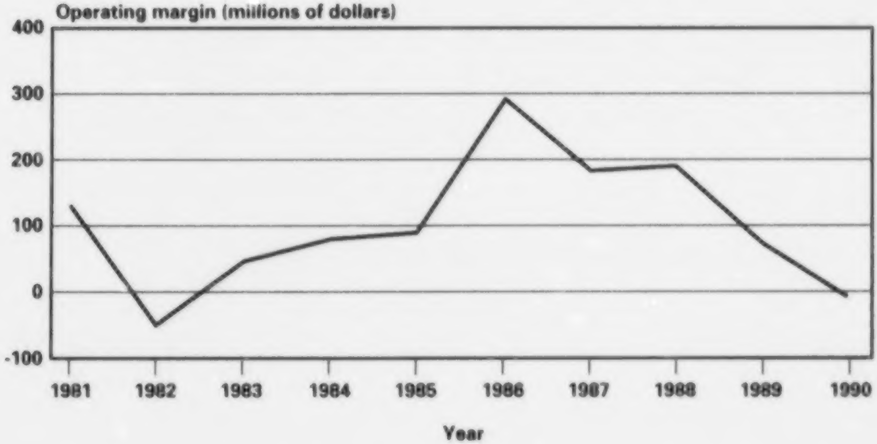
The operating margin[81] in Canada for Level I airlines[82] is shown in Chart 4. The margin was negative in 1982 and 1990. Indices of the margin and two output measures are shown in Chart 5. As the index of passenger traffic and freight carried rises, the margin shows great volatility and no upward trend.

There has also been no decrease in the volatility of the margin over the different months of the year as shown in Chart 6. This volatility is consistent with greater stability in the load factor over the year. The industry is capital intensive, and interest costs can squeeze margins. The percentage of interest expenses to operating expenses is presented in Chart 7. There is

*Chart 4*

*ANNUAL OPERATING MARGINS*

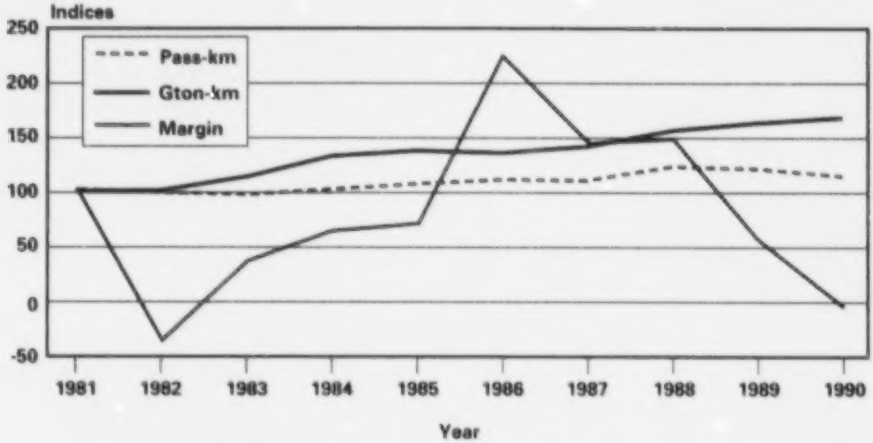
*LEVEL I CARRIERS*



**Source: Statistics Canada, CANSIM.**

**Notes: Margin is operating revenue (CANSIM D462215) less operating expense (D462216). 1990 margin estimated based on 9 months data.**

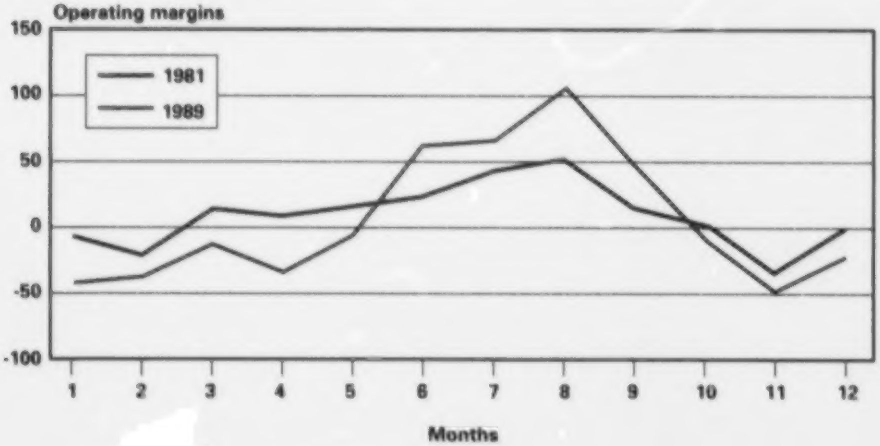
## Chart 5
## AIRLINE LEVEL I, 1981–1990
## OUTPUTS AND MARGIN



Source: Statistics Canada, CANSIM.

Notes: Raw data from CANSIM D462210, D462212, D462215 and D462216.
Margin for 1990 estimated based on 9 months of data.

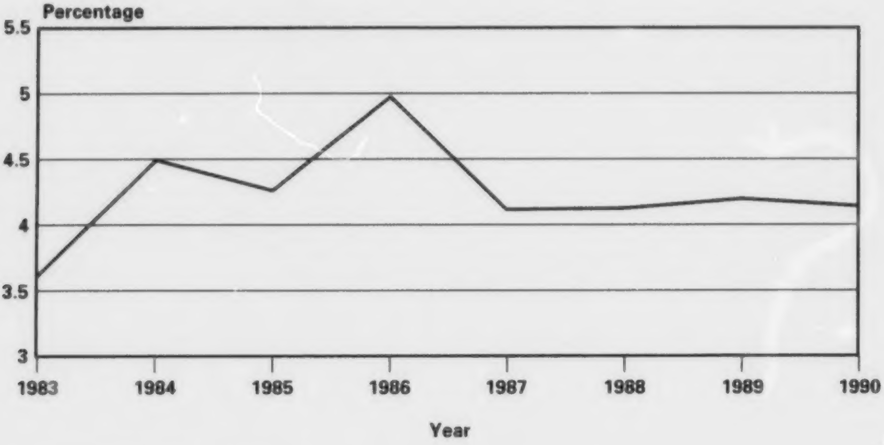
## Chart 6
## MONTHLY PATTERN OF OPERATING MARGINS
## LEVEL I CARRIERS — 1981 AND 1989



Source: Statistics Canada, CANSIM.

Note: Margin is operating revenue (CANSIM D462215) less operating expense (D462216).

*Chart 7*
*INTEREST TO OPERATING EXPENSE PERCENTAGE*
*LEVEL I CARRIERS — ANNUALLY*



**Source: Statistics Canada, CANSIM.**

**Notes: Interest (CANSIM D462217) to operating expense (D462216). 1990 based on 9 months.**

no indication that this ratio has been extremely volatile, and it reached its peak in the same year, 1986, that the operating margin peaked.

Profit rates are hard to measure because of the difficulty of assessing economic depreciation in the industry, and reasonable observers disagree about their level. Despite this ambiguity, there does not appear to be any convincing evidence of excess profits, and no analyst claims the contrary. However, since the current regulatory regime has been in place for only a short time, the profit position of the airlines needs to be monitored closely. Considerable information is needed to identify trends in this industry, as profit margins are extremely sensitive to the general level of prosperity.

Another possible concern is that the lack of overall excess profits is masking monopoly profits on non-competitive routes. With no overall excess profits being made, compensating losses must exist on the other routes flown. If there are no scale effects, the airlines would presumably drop the losers, and excess profits on their total operations would surface. If instead, costs on different routes in a network are interrelated with each other and with the details of the network configuration, profit margins on individual routes that ignore these interdependencies are misleading measures for guiding public policy.

## 6. THE NUMBER OF CARRIERS AND THE EXERCISE OF MARKET POWER

As noted above, the city-pairs accounting for the bulk of Canadian air traffic are served by two or more competing carriers. There remains some uncertainty regarding the number of carriers required on a route to ensure that passengers have the benefit of competitive pricing. Fares may be competitive with one carrier if a route is contestable. The question of contestability is addressed in the next section.

The relationship between pricing and the number of carriers presently serving a route depends on the nature of the interaction among them. If the flights offered by each carrier are indistinguishable, and each carrier sets its fares on the assumption that the other(s) will maintain theirs at existing levels, then fare levels will be driven to marginal cost when there are two or more carriers on a route. This is what is known in price theory as undifferentiated Bertrand competition. When competition takes this form, fare revenue is not sufficient to cover fixed costs. For this reason undifferentiated Bertrand competition is sometimes called destructive competition, and it cannot prevail over the long run.

If the flights offered by each carrier are indistinguishable, and each carrier assumes that rivals will maintain their capacity on the route and adjust fares to maintain load factors, then fares will exceed marginal cost — approaching it asymptotically as the number of carriers on the route becomes very large. This is known as undifferentiated Cournot competition. Taken together with free entry, this form of competition results in fares that approach average cost.

Incumbent carriers may also agree tacitly to share the traffic on a route in roughly fixed proportions. In this case fares will remain at the monopoly level regardless of the number of carriers on a route. It may become increasingly difficult, however, to maintain a market-sharing arrangement as the number of carriers on a route increases.[83]

The assumption that the respective flights of individual carriers on a route are indistinguishable does not seem very realistic. Individual flights may be differentiated with respect to departure times and connections as well as the number of stops, the airport (Pearson or Toronto Island, for example), the type of equipment and cabin service. In this case it is more difficult to talk about "the price" because the offering differs. If the differentiation is assumed to be simple, involving only departure times, for example, it can be shown that the fare charged by each carrier declines as the number of carriers on a route increases.[84] Fares would tend to marginal cost only if allowed departure times were virtually adjacent, and the fixed costs of offering a flight were very low.

The empirical evidence on the relationship between the fares and the number of carriers on a route in the United States has been cited above. Some evidence suggests that two carriers are sufficient to generate competitive fares. This is consistent with the undifferentiated Bertrand model. Other evidence implies that it may take up to five carriers on a route before competitive results are achieved. This is consistent with a variety of models including the Cournot, market-sharing and differentiated product models.

The unprofitability of most airlines in recent years is consistent with either undifferentiated Bertrand (destructive) competition or with free entry. The continuing presence of price discrimination is not consistent with undifferentiated Bertrand competition. Moreover, the evidence cited in the next section implies that barriers to entry do exist. Thus it is difficult to characterize the nature of the oligopolistic rivalry among airlines with any precision on the basis of the evidence presently available.

The relationship between fares and the number of competitors on Canadian routes does not appear to have been subject to the same type of analysis. The National Transportation Agency has noted the salutary effect of competition on fare levels in several of its northern fare investigations.[85]

## 7. CONTESTABILITY

Contestability draws attention to the disciplining power of potential competition — of the deterring effect of credible threats to enter. The concept has venerable roots, although it has recently been rediscovered, refined and given a patina of mathematical respectability. The central idea was clearly and subtly articulated by Schumpeter:

> It is hardly necessary to point out that competition of the kind we now have in mind acts not only when in being but also when it is merely an ever-present threat. It disciplines before it attacks. The businessman feels himself to be in a competitive situation even if he is alone in his field or if, though not alone, he holds a position such that investigating government experts fail to see any effective competition between him and any other firms in the same or a neighbouring field and in consequence conclude that his talk, under examination, about his competitive sorrows is all make-believe. In many cases, though not in all, this will in the long run enforce behavior very similar to the perfectly competitive pattern.[86]

For the purposes of this study, it is useful to distinguish between contestability with a single homogeneous service and with a number of differentiated services. Consider first a situation in which each flight is sold at the same price, and the market is supplied by a single carrier. Perfect contestability describes a polar case in which the threat of competition has a maximum effect. It requires that the potential entrant have the same costs of providing service as the incumbent, and some mechanism should exist for the potential entrant to contract with customers without cost. The entrant can offer better terms to passengers currently flying with the incumbent, and they can switch their business without cost. To keep its existing customers, the incumbent has to price services with no excess profit. If that did not occur, the entrant could decrease the price slightly and still be viable.[87]

If travellers can be separated into different groups by differentiating service, perfect contestability ensures that no subscribers to a service class can do better by contracting with a potential entrant alone, or in conjunction with some of the other groups, or in a grand alliance with every group being currently served.[88] When price discrimination is possible, there may be a number of price packages for each service class that defend the incumbent against the challenger. Each choice within this set of sustainable break-even pricing options involves different contributions from each of the service segments.

The more contestable a market is the less the need for oversight and intrusive regulation. The degree of contestability depends on the costs of potential entrants and the barriers to entry. For a particular route, other active airlines obviously have expertise in providing service. However the network configuration of the potential challenger can raise its cost of providing service to the particular city-pair. There may be none or only a few carriers which can integrate the route as effectively into their current network as the incumbent. Foreign airlines with effective cost configurations would widen North American air service if they were permitted to enter the market. In Canada, American airlines with adjacent networks would be particularly effective.

Barriers to entry are costs imposed on an entrant but not the incumbent. In considering contestability and air service, many analysts focus on the fact that the airplane is not considered sunk capital and is suitable for "hit-and-run" entry into a market. In classroom discussions the airlines become the archetypal example of a perfectly contestable industry. The real world has failed to confirm that hypothesis. There are many other valuable informational and structural assets involved in providing airline service which are sunk. Barriers to entry alleged to exist in airline service include control over airport slots, gates and ancillary facilities; frequent flyer programs; feeder line control and hub or route concentration effects; computer reservation systems and graduated travel agent commission schedules; and predatory pricing.

The airport congestion problem in Canada is an issue at Toronto and Vancouver. It and various externality problems can be alleviated by appropriate pricing of airport facilities. Halting steps are being taken in this direction. Unfortunately, as noted by Soberman, the media have focussed attention on less-pressing issues than price rationalization and the provision of, and access to, airport facilities:

> The capacity of Toronto's Pearson International Airport, for example, is a real issue. It affects costs, aviation safety, and congestion for much of the remaining domestic airline network. By contrast, recent VIA Rail cuts were perceived by numerous elected officials and newspaper editorialists to create real problems of urban traffic congestion. In fact, in a place like Toronto, all VIA services accounted for about 200 commuters per day in comparison with the 1.7 million passengers per day carried by all other public transportation agencies.[89]

With appropriate pricing, an incumbent would face the same cost of using airport facilities as would an entrant, and no barrier to entry would exist. The gains appear to be so considerable from proper pricing of airport facilities that it is difficult to understand the political hesitation in implementing appropriate systems. Political opposition, however, is ubiquitous. For the United States in 1989, Hahn and Krozner reported that a small private plane could land for a US$6 charge while a commercial jetliner paid between US$90 and US$200, although both caused the same congestion effects. They also noted that Congress limits the revenue-raising abilities of airports which receive federal financial aid and has imposed restrictions prohibiting the levying of "passenger facility charges."[90] Perhaps the key to reducing this opposition is to stress the externality control features of pricing as well as the more obvious alleviation of financing difficulties.

Gaining access to congested airports can be avoided by entrants flying into and out of other airports that serve the same or contiguous areas as the major airport. The lack of such alternatives for major Canadian routes prompted Lazar to comment in 1984:

> There are only two sets of markets that have the traffic potential to support multi-frequency, end-to-end, turnaround routes such as those flown by People Express and Southwest. These markets are the Vancouver–Calgary–Edmonton and the Toronto–Ottawa–Montreal–Quebec City groupings. In none of these cities however, is there a close-in and/or relatively uncongested second airport that can accommodate jet aircraft.[91]

Alternative airports exist for commuter traffic on shorter routes, and since 1984 the capabilities at a number of these have been enhanced. Partly in response to congestion at Pearson International, traffic has risen at Oshawa, Hamilton (jet capacity), Buttonville and Toronto Island airports. The development of even more sophisticated facilities at these alternative sites may enhance competition even further, although the area air traffic control problem may be exacerbated.

Another aspect of the airport access problem is the domination of an airport by one or two carrier systems. Feeder traffic is critical to the operation of a hub-and-spoke system. Density on many feeder routes can often support only one supplier. Contractual links or ownership of these feeders has been cited as another barrier to entry:

> Air Canada and CAIL have been successful in purchasing all of the feeder carriers of any importance in Canada. By preventing their feeder subsidiaries from signing interlining agreements with other carriers, or from putting in joint fares with other carriers, they are excluding new entrants from the trunk airline routes from important

> segments of trunkline markets. Just prior to Wardair's demise, it announced that it was going to pay feeder airline fares, at great expense, in order to get access to an important segment of the scheduled airline market.[92]

Exclusive contracts and refusal to supply are addressed by competition policy. This study did not uncover any idiosyncrasies which would dictate a special governance arrangement for competition practice in air service.

Tretheway referred to frequent flyer programs "as a powerful entry barrier."[93] For the United States, Winston and Morrison estimated that a frequent flyer program is valued at US$32.01 per round trip of an average length over their sample.[94] A fledgling or local airline offering service between points A and B only cannot launch an effective self-contained plan. The frequency of use by a typical business passenger may not generate enough credits and for the passenger who does qualify for a prize, winning yet another trip to B may generate minimal excitement. This is true regardless of whether the airline has just begun business or has been offering service for a long period of time. The barrier is not one of entry but of size. The constraint is that the "in kind" volume bonus has to be attractive. A non-airline company which could offer attractive prizes from its existing services could take over a single route and immediately implement a competitive marketing plan. Prizes for volume purchasing could take a number of forms including waiving credit card fees, "free" vacations at some resort or free options on the purchase of an automobile, depending on the price cost margins in the portfolio of products and services sold by the parent company. "In kind" bonuses are ubiquitous in Canada, ranging from Canadian Tire script to obtaining three for the price of two. Presumably, airlines offer prizes in the form of flights rather than other "in kind" prizes, because it aids their load management.

An affiliate of one of the two major carriers may enter into a single-carrier route, or if the existing carrier is part of one system, an affiliate of a rival system may enter. In either case, the entrant would already be linked into a viable frequent flyer program, and no competitive problem would arise from this source. A small airline, which is not an affiliate, can negotiate inclusion in the plan of AC, CAIL or a foreign line. For example, when Intair departed the CAIL family to fly as an independent, it offered a frequent flyer program in conjunction with American Airlines and KLM.

Organizational innovation is an important competitive element in a small-numbers service industry. Pricing innovations have diffused quickly in this industry. Since a frequent flyer program represents a pricing initiative which is attractive to customers, it is not advantageous to prohibit such plans[95] or tax them.[96] For a low enough level of tax that would still give entrants an incentive to develop their own plan, entry would not be encouraged. For a level of tax at which an entrant without a plan could compete with an incumbent who maintained a taxed plan, entry would be subsidized. A large enough tax that would prevent anyone offering a plan would be the same as a prohibition.

Remedies which enhance competition by other means than proscribing or implicitly taxing those dimensions of service which one class of firms (in this case large firms) does better are preferred. The frequent flyer plans may be improved by disclosure requirements or even access requirements. However, the most effective pro-competitive step available is to broaden access to alternative sources of frequent flyer schemes through a North American, or preferably more widely based, air pact.

Morrison and Winston estimated the competitive advantage conferred by a hub to be US$25.66 on their representative American round trip.[97] The new hub-and- spoke network architecture reduces costs and increases the options available to passengers. Canadian independent airlines can make feeder arrangements with American airlines but opportunities are restricted. Before its demise, City Express was negotiating a feeder agreement with Continental Airlines. Reducing the barriers to competition between configurations can be encouraged by removing artificial barriers to international competition. In this instance, a North American pact would be sufficient to harvest the benefits.

What is essentially a regulatory remedy has been adopted in Europe, the United States and Canada with respect to computer reservations systems.[98] In 1989 after submitting the proposed merger between Reservec and Pegasus to the Competition Tribunal, the Director of Investigation and Research amended his application to permit the merger if a proposed set of rules governing the operation of the enlarged computer reservation system (CRS) and access to it was adopted. The Tribunal approved the merger and a modified set of rules in mid-1989. After the decision, the Minister of Transport directed Transport Canada and the National Transportation Agency to develop appropriate regulations for reservation systems.

Even with a regulatory code in place, a barrier to entry may persist. Algorithm bias, halo effects such as commission payments based on CRS use and the market intelligence conveyed provide the CRS carrier with an alleged advantage. In evidence given before the Canadian Competition Tribunal, Michael Levine, a dean at Yale and a former executive at New York Air, argued for divestiture of CRSs from the carriers because regulation of them had failed:

> Detailed regulation in the United States has succeeded in reducing incremental revenue effects from 50% or more to "only" 13–20% (estimate of the U.S. Department of Transportation), but that compares with typical airline profit margins of 5% or less, suggesting that even a heavily regulated CRS sufficiently distorts competition to make the difference between success and failure in the marketplace.[99]

Although the same remedy was not recommended, the same concern was expressed by the American Secretary of Transportation's Task Force:

> In certain areas, the rules have not worked as well as the CAB originally intended. In particular, the issue of allegedly restrictive subscriber contract provisions and practices remains one of the most controversial CRS policy issues. In addition, the prohibition on display bias did not eliminate incremental revenues. Finally, the CAB's expectation that booking fees could be controlled by the bargaining power of major non-vendor airlines proved unrealistic.[100]

Bailey and Williams argued that the CRS and hub domination reinforce each other as barriers to small entrants:

> One use of these (CRS) systems has been to enhance high-volume control at large hubs. Since deregulation, American's system has come to process 88 percent of ticket sales in the Dallas–Ft. Worth market, United's to process 72 percent of the Denver market, and United's and American's together to process 83 percent of the Chicago market. Thus, American's Sabre System and United's Apollo dominate the travel agencies in the hubs where these carriers operate, enhancing local monopoly rents from these geographic regions as well as scale-based rents over competing carriers. Both sources of rent are thereby enhanced for these especially powerful carriers.[101]

In Canada, entrants that have challenged AC and CAIL have subscribed to other CRSs. Intair aligned itself with Sabre, the CRS of American Airlines. Before its takeover by CAIL, Wardair subscribed to System One, the CRS of Texas Air.

In the United States major airlines which do not have their own CRS often buy into the CRS of another carrier. For example, the Apollo system is 50 percent owned by United, with Alitalia, British Airways, KLM, Swissair and USAir owning 49.9 percent. Air Canada recently purchased a 1 percent interest in this system. These private responses are similar to those observed with bottleneck facilities like pipelines. They provide some insulation to existing airlines from exploitation. They may make entry easier by setting a precedent on the terms and conditions for ownership participation in a CRS, but on the dark side they may facilitate the coordination of incumbents to fight entrants.

CRSs require common conventions as to format and structure. For this reason, as well as the barrier to entry concern, regulation may be warranted. However, regulation may affect system innovation. In the personal computer field there has been a spectacular increase in power, an explosion in sophisticated applications and a marked reduction in real price generated in the absence of regulated operating systems and architecture.

To what extent would the adoption of such systems have stifled this remarkably innovative sequence? Any stifling effect has to be balanced against an acknowledged reduction in a barrier to entry. The Bureau of Competition Policy and the Tribunal are not the best-suited institutions for ensuring a flexible evolution of the code which neither penalizes nor subsidizes entry.

Graduated travel commissions are another source of concern for small entrants. Although traditionally based on total ticket sales, more recently airlines have been targeting particular routes. The rate of override also increases as the share of the agency's business directed to the carrier increases. Large organizations can protect themselves by private contracting and these arrangements reduce the barrier to entry. An example is provided by the American Department of Transportation's Task Force:

> Consequently, some agencies and corporate clients have shifted to a fee system, where the client, not the air carrier, compensates the agency by paying it a fee. The agency then turns its airline commissions

> over to the client. The fee system would help ensure that the agency's incentives are consistent with the client's expectation that the agency's goal is to provide it with the best possible service and would reduce the uncertainty facing an agency over the adequacy of its compensation.[102]

With respect to predatory pricing, it is alleged that carriers have selectively responded to incursions by low-price entrants or by other incumbents breaking an established pattern of pricing. As of the end of June 1990, the U.S. Justice Department was proceeding with four cases involving alleged collusion, predation or attempts to block entry against airlines.[103] In one of these cases carriers are accused of using the monitoring service of the Airline Tariff Publishing Co. to signal that new fares were in retaliation for the pricing aggressiveness of others.

People in the industry say the crucial signals between carriers translate as follows: "Let me determine the price at my hub airport and I'll let you do the same at yours." The most common — and perhaps most questionable — "discussion" between airlines is played out like this: Carrier A, often a smaller operator such as Midway Airlines or America West, attempts to boost its business by lowering ticket prices. It enters lower fares in the industry's computer system. In response, Carrier B, the dominant carrier at the affected airport, not only matches the new fares, but lowers them in other markets that are served by Carrier A.[104]

Alfred Kahn did not include predation in his discussion of the events that surprised him about airline deregulation:

> I take perverse satisfaction in having predicted the demise of price-cutting competitors like World and Capital Airways if we did nothing to limit the predictable geographically discriminatory response of the incumbent carriers to their entry, and in having rejected the conventional wisdom that predation would not pay because any attempt to raise fares after the departure of the price-cutting newcomers would elicit instantaneous competitive reentry.[105]

Although competition policy can be mobilized if the threat of predation is a significant barrier to entry, there are particular difficulties in identifying predation in the airline industry. Prices are frequently regarded as predatory, if they are below incremental cost. Incremental cost is an ambiguous concept in this industry. It depends on the time horizon adopted. It also may have an opportunity cost component that will not be evident in accounting data. Prices are sometimes regarded as predatory if they are discriminatory. In this market discrimination is likely to be a feature of an efficient equilibrium. It may be difficult to determine when a change in the degree of discrimination is a predatory rather than a competitive response.

## 8. INSTITUTIONAL DEFENCES AGAINST MARKET POWER

City-pair airline markets may not be perfectly contestable, and the lower density routes may be characterized by small-numbers competition. This raises concerns about the possible exercise of market power on these routes. Contestability may be limited by any or all of incumbent control over airport slots, gates and ancillary facilities; frequent flyer programs; feeder line control and hub or route concentration effects; computer reservation systems and graduated travel agent commission schedules; and predatory pricing.

Defences against the excercise of market power may take any of three forms:

- further deregulation;
- residual rate and fare regulation and/or the imposition of access requirements; or
- decentralized public and private responses.

### FURTHER DEREGULATION

While it does constitute a considerable liberalization of the regulations governing air and other forms of transportation, the *National Transportation Act, 1987* retains some provisions which may reduce the contestability of city-pair airline markets. The first of these is the requirement under section 76 that an incumbent carrier give 120 days' notice before dropping a service or reducing its frequency to less than once a week. This requirement effectively commits the incumbent to the market for four months regardless of the attractiveness of a new entrant's offering. The legislation requires the incumbent to "stand and fight" and undermines the contestability of the market as a consequence.

A second restrictive feature of the Act is the requirement under section 72 that all carriers be 75 percent Canadian owned. This restriction could be relaxed by Order in Council. This would increase the number of potential entrants and may also increase the discipline imposed on incumbents by the threat of entry. U.S. carriers may be well-placed to enter some domestic Canadian routes or to link various Canadian cities via their U.S. hubs or regional hubs. In addition, U.S. carriers are already realizing frequent flyer, CRS and other network economies. They would have less, if any, need for regulatory intervention to ensure their credibility as entrants.

## RESIDUAL RATE OR FARE REGULATION

The National Transportation Agency has the power to control economy fares on southern routes where there is an absence of effective competition. Thus the option of imposing fare ceilings on monopoly routes still exists. The appropriate definitions of a monopoly route and of what constitutes a competitive fare are dealt with below. In this regard the U.S. experience with defining monopoly rail routes and with setting rates on them in the post-*Staggers Act* period is instructive as is the Canadian experience with competitive line rates on railways and with fare regulation on monopoly bus routes.

### The *Staggers Rail Act*

The *Staggers Rail Act* left the Interstate Commerce Commission (ICC) with limited jurisdiction over railway freight rates. The ICC can order that a rate be raised to average variable cost which is the minimum "reasonable" rate under the Act. The ICC also has the power to set maximum rates under a restricted set of circumstances. Specifically, the ICC may investigate the reasonableness of a rate if it exceeds 180 percent of variable cost and the carrier has market dominance. If the rate is found to be unreasonable the ICC may order it to be reduced. Any rate below 180 percent of variable cost or which is set by a railway which is not in a position of market dominance is presumed reasonable.

The existence of any one of four forms of competition is sufficient to disprove market dominance. These are:

- intra-modal competition: competition from another railway;
- intermodal competition: competition from road or water transport;

- geographic competition: the ability of a receiver to obtain the product to which the rate in question applies from another source or of the shipper to ship it to another destination; and
- product competition: the ability of the receiver to use a substitute for the product to which the rate in question applies or the ability of the shipper to make and ship a substitute.

Railways deemed to be "revenue inadequate" may further increase their rates by 4 percent annually even if these rates exceed 180 percent of variable cost, and market dominance exists. This is called the "zone of rate flexibility." At present all U.S. railways are deemed by the ICC to be revenue inadequate, that is, earning less than their cost of capital.

In its assessment of the reasonableness of rates which exceed the 180 percent of variable cost, for which there is market dominance and which are not in the zone of flexibility, the ICC uses a "constrained market pricing" approach. Constrained market pricing is based on two principles. These principles are "differential pricing" and "stand-alone cost." The principle of differential pricing is that a greater proportion of common costs should be recovered from the customers with the less elastic demands. Differential pricing is thus a simplified version of Ramsey pricing. Because prices exceed marginal cost by the largest amount in the market segments in which this has the smallest effect on demand, Ramsey pricing minimizes the distortion in output associated with the recovery of a given level of fixed costs.

The stand-alone cost principle is that no shipper should pay a rate higher than the lowest stand-alone average cost of serving that shipper or any group of shippers. This is what any shipper would pay if the market for freight services were contestable. That is, given contestability, a railway that charged shippers more than the stand-alone average cost of serving them would lose the market to a new entrant.

The application of these two principles was illustrated by Willig and Baumol.[106] Suppose that a railway serves markets S and T. Variable costs are $80 in each market, and there are common costs of $40. Suppose further that as a result of intermodal competition customers in the S market can only be charged $80. Then customers in the T market pay $120 which is the variable cost of service plus the fixed costs. This $120 is also the cost a new entrant would incur in serving the T market alone.

Roberts pointed out that the practical application of the stand-alone average cost ceiling to captive railway shippers presents a number of difficulties. First, it may be difficult to determine what the costs of a specific component of an integrated rail network are. Second, it may also be difficult to determine the group of shippers a hypothetical new entrant might serve.[107]

There has been considerable dissatisfaction among captive U.S. shippers with the ICC's constrained market pricing approach. Mid-western coal shippers have been the most vocal. Dunbar and Mehring found, however, that at least during the early years of the *Staggers Act*, real, distance-corrected coal rail rates fell on average.[108]

Roberts has proposed an alternative to the stand-alone cost approach to determining rate ceilings.[109] He suggests that all shippers paying rates above the system average price–marginal cost ratio be treated as a class. The rates paid by this group would all have the same ratio to marginal cost. This ratio would be sufficient to cover all fixed system costs. In the terms of Willig and Baumol, the hypothetical entrant is the same as the railway's existing network and the hypothetical group of customers is all customers currently discriminated against (in the sense of paying above-average price-cost margins).

## Competitive Line Rates on Canadian Railways

Sections 134–143 of the *National Transportation Act, 1987* provide for the establishment by the National Transportation Agency of competitive line rates. A competitive line rate may be established between either the point of origin or the point of destination of a shipment and a connecting rail carrier. A competitive line rate cannot be applied over more than 50 percent of the distance between the points of origin and destination or 750 miles whichever is greater. The formula to be applied in determining the competitive line rate is given in section 137. The competitive line rate is the interswitching rate plus the revenue per mile of the connecting carrier multiplied by the number of miles over which the competitive line rate is to apply less the distance over which the interswitching rate applies.

The first competitive line rate case decided by the National Transportation Agency under the 1987 Act is described by Lande.[110] The case involved shipments of methanol by tank car from Medicine Hat to Shelby, Montana.

The shipper, Alberta Gas & Chemicals Ltd. was captive to CP Rail at the point of origin but could interswitch with Burlington Northern. Alberta Gas had a rate from Burlington Northern but could not agree with CP on a rate on its portion of the route. The Agency set the CP rate at the Burlington Northern rate per ton-mile in Canadian dollars times the CP mileage in excess of the interswitching distance plus the interswitching charge. This rate has been renewed twice by the Agency.

### Extra-provincial Bus Transport

Section 195(2) of the *National Transportation Act, 1987* states that the National Transportation Agency "may, by order, disallow any tariff of rates or any portion thereof if, in its opinion,

(a) the tariff or portion thereof is not compensatory and is not justified by the public interest; or

(b) there is no effective alternative and competitive transportation service by a common carrier . . . and the tariff of rates unduly takes advantage of a monopoly situation."

A 1986 Canadian Transport Commission decision under section 40 of the 1967 Act illustrates the factors likely to be considered in determining whether a bus fare is unduly monopolistic. In *Re TerraTransport* (Decision number MV-40-224), the Motor Vehicle Transport Committee of the Commission found no justification for disallowing a 5 percent increase in fares on the Roadcruiser bus service in Newfoundland.[111] Its reasons were that TerraTransport was not and had not been profitable, there was no evidence of excessive or misapportioned costs or of an overall deterioration in service, and there was no indication that past fare increases had themselves discouraged traffic appreciably. The Committee also implied that it would continue to look favourably on fare increases at TerraTransport until the latter was earning "a reasonable rate of return which would generate enough capital to reinvest in the operation in order to maintain and, if there is sufficient demand, to expand the service."[112]

# 9. IMPLICATIONS OF NORTHERN ROUTES AND OTHER MODE REGULATION FOR OVERSIGHT OF FARES ON MONOPOLY AIRLINE ROUTES IN CANADA

## DEFINING A MONOPOLY AIRLINE ROUTE

The factors which might be considered in defining the routes on which the carrier(s) might have market power include:

- the number of carriers on the route (intra-modal competition);
- the ability of additional carriers to offer service on the route (barriers to entry or contestability);
- the number of carriers serving the same city-pair by different routes (interhub competition); and
- the existence and time and cost comparability of alternative modes of transportation including automobile, bus and train (intermodal competition).

There are a number of alternative standards for regulatory intervention. If the objective is to confine regulatory intervention to cases in which the excercise of monopoly power is highly probable, the city-pairs selected for scrutiny (either reactive or proactive) would be served by a single carrier, have significant barriers to entry, and have ineffective interroute (including interhub) or intermodal competition.

Factual evidence of barriers to entry would include restrictions on the access of potential entrants to physical and intangible infrastructure, specifically:

- lack of access to counter or gate space or arrival/departure slots;
- lack of access to interlining privileges;
- lack of (or inferior) access to computer reservation services; and
- lack of access to frequent flyer programs.

Factual evidence would also include the characteristics of potential entrants. Morrison and Winston define a potential entrant as a carrier serving both the origin and destination points on a route but not the route itself.[113] It would be of considerable interest to know how many single carrier routes in Canada have such "first tier" potential entrants. It should also be noted in passing that the statistical results of Morrison and Winston imply that, other things being equal, the fare on a route declines as the number of "first tier" potential entrants increases but that this relationship is not statistically significant.[114] This might be taken to imply that the constraint imposed on incumbents by "second tier" potential entrants who serve either the point of origin or the point of destination of a route but not both and not the route itself is minimal.

More theoretical types of evidence would involve an examination of the characteristics of the route involved and how these might affect the reaction of an incumbent carrier to entry. Do sunk costs and/or regulatory restrictions on exit commit incumbents to the route? Incumbents may be particularly difficult to dislodge from routes where either the origin or the destination is their hub.[115] Are fixed costs such that the incumbent(s) and the entrant cannot both earn normal profits on the route? If so, excess profits need not induce entry even if access to the requisite infrastructure does exist.

Evidence regarding the competitiveness of alternative modes might include their respective frequencies, connections, fares and travel times.

## DEFINING A REASONABLE FARE

Having established the type of route on which fare regulation has a reasonable probability of being beneficial, the task is then to establish the criteria for adjudicating fares. One approach would be to set fare caps. These caps could take the form of those presently available to captive shippers under the *Staggers Act*. Fares on monopoly routes would be subject to maximum price–variable cost ratios. The maximum ratio would be such that passengers on the route in question pay no more than the stand-alone average cost of their service.

The approach taken by the National Transportation Agency to the reasonableness of northern air fares is somewhat different. The Agency calculates service-specific and possibly route-specific rates of return as well as system rates of return. These calculations assume that both overhead costs and capital can be apportioned to a particular service or route. This implies that overhead services and the services of capital equipment can be rented in small amounts (that is, an airplane for two days per week or ground personnel or equipment for two hours per day). In contrast the stand-alone cost approach allows for indivisibilities in various functions. In other words, a service may have to bear the entire cost of an airplane if the latter cannot be rented elsewhere when it is not in use on that service.

The Agency's northern fare investigations have not needed to address the issue of differential pricing. Would the Agency allow an excess return on a particular route if the system as a whole was earning normal or less than normal returns? This is likely to be the issue confronting fare regulation on southern monopoly routes in the next few years.

The stand-alone cost approach taken by the ICC appears preferable here. The National Transportation Agency's practice of allocating overheads on a *pro rata* basis implies equal price-variable cost margins across routes or services. While this may have political appeal, it is not what would happen in a contestable market with indivisibilities. If the regulatory process is to approximate the competitive and allocatively efficient outcome, fares should be allowed to exceed variable cost by the amount of fixed unit stand-alone cost. This is likely to differ considerably from route to route.

The stand-alone cost approach rules out the approach to rate-making embodied in the competitive line rate. The imposition of a competitive line rate would imply a requirement that the fare per mile on the monopoly portion of a flight be the same as on any connecting competitive portions. Given differences in equipment and traffic densities there is a strong likelihood that a fare specified in this manner would not cover stand-alone average cost.

It should be noted that, given the vast and variable array of fares now offered on most routes, the imposition of a regulatory ceiling on the economy or Y-fare protects a relatively small fraction of air travellers. Monopoly power can be exploited by manipulation of the discount structure and by withdrawal of discount fares which "forces" travellers to fly at the Y-fare or not at all. The importance of discriminatory pricing poses a considerable regulatory problem. Regulation of a Y-fare at which few people fly is somewhat redundant. Regulation of discount structures and their availability is likely to be complex and costly for all concerned. The controversy over the regulation of freight rates on bulk coal which ought to be a relatively simple task should serve as a warning to those contemplating the regulation of the full spectrum of fares and their availability on monopoly routes.

Moreover, discrimination can result in the marginal user being served at marginal cost and is thus allocatively equivalent to competition under some circumstances. The efficiency consequences of regulating the entire spectrum of fares on monopoly routes are ambiguous at best and are, in all probability, negative once the cost of the regulatory apparatus is taken into account. This leaves Y-fare regulation as a kind of "life line" regulation which guarantees a "reasonable" full cost fare which is always available although it may be infrequently used.

## ACCESS REQUIREMENTS

In its provisions relating to rail regulation, the *National Transportation Act, 1987* gives the National Transportation Agency the authority to require that other railway companies be accorded various forms of access to shippers who would otherwise be captive to a single railway. Some of these access provisions may be applicable to air transportation. They might then be employed to increase the degree to which monopoly routes are contestable. These access provisions and Canadian experience with them are described below.

The Act contains a number of provisions which allow a shipper served by a single carrier to have access to competing carriers. These access provisions are as follows:

- *Running rights:* Under section 148 a railway company may, with the approval of the National Transportation Agency, use the whole or any portion of the tracks, terminals, stations or station grounds of any other railway company and exercise full rights and powers to run and operate its trains over any portion of the railway of another railway company. The Agency may fix, by order, the privileges and obligations of each railway as well as the required amount of compensation.
- *Joint use of right-of-way:* Under section 149, the Governor in Council may order the joint or common use of the right-of-way of a railway by two or more railway companies if it is satisfied that this would result in significant efficiencies and reductions in cost. The Governor in Council may also fix by order the extent of this joint or common use and the compensation that must be paid.

- *Connection of intersecting railway lines:* Under section 150, the National Transportation Agency may order that railway lines that intersect, cross or run through the same urban or industrial area be connected to permit the safe and convenient transfer of traffic between the lines and the interswitching of traffic between the railways involved. The Agency may determine and apportion the cost of effecting and maintaining this connection. Under section 151, the Agency may, in conjunction with the relevant provincial regulatory board, also order the connection of intersecting, provincially regulated railways.
- *Interswitching:* Under section 151(1), where a line of one railway company connects with the line of another railway company, the Agency may, on the application of the company owning either of the railways involved or of a municipal corporation or other interested party, order the companies that operate those lines to afford all reasonable and proper facilities for the safe and convenient interswitching of traffic between those lines. Under section 151(2), where the point of origin or destination of the traffic is within 30 kilometres of the interconnection point (the interswitching limits) the terms and conditions under which interconnection occurs must be as determined by the Agency. The Agency may also extend the interswitching limits if the point of origin or destination is "reasonably close" to the point of interchange.

With respect to the application of the access provisions of the Act, the Agency has made one order under section 150 requiring that two railway lines be interconnected. In 1990 it ordered that the Port Stanley Terminal Railway be connected with CP trackage at St. Thomas, Ontario.[116]

A number of requests for running rights under section 148 have been submitted to the Agency. One involved an application by CP Rail for running rights over 10 miles of CN trackage in order to serve two large chemical producers in the Fort Saskatchewan Alberta area. The two railways ultimately settled the matter privately.[117] Another application filed under section 134 of the 1967 Act involved the use of facilities, namely, the CP passenger station in Regina by VIA Rail. This was also settled privately. Three applications for running rights are currently under review by the Agency. These involve two short-line railways in Ontario and a proposal to run highway trailers on bogies on CN tracks between Moncton and Windsor.

Interswitching has been a feature of Canadian railway regulation since 1908. The National Transportation Agency sets interswitching rates and adjudicates applications for extension of the interswitching limits (currently within 30 kilometres of the interchange point) within which regulated terms and conditions apply. The Agency recently denied an application by CIL of West Carseland, Alberta to be included within the interswitching radius of Calgary. Its reason for denial was that CIL was not disadvantaged with respect to its freight costs.

Regulation may enhance the bargaining power of passengers on monopoly air routes in the same way it has enhanced the bargaining power of captive rail shippers. The analogy between the rail access provisions in the *National Transportation Act, 1987* and possible access provisions for city pair airline markets is somewhat strained but it does serve to illustrate the alternatives.

### Running Rights or Joint Use of Right-of-Way

The city-pair airline market analogy to these rail access provisions is the right to use the incumbent's ticketing, baggage handling or servicing facilities and personnel at either or both the point of origin or destination. The moral hazard problems could be such as to require a great deal of regulatory supervision. The problem would be less severe if these services were provided by outside contractors. Access could then be facilitated by prohibiting exclusive contracts. Flint notes that one feature of airline deregulation in Australia has been to require the existing carriers (Ansett and Australian) to make gates that would otherwise be tied up in long-term leases available "at market lease rates" to other carriers.[118] Flint goes on to note, however, that this involves only two gates each at Sydney and Melbourne and one gate each at Adelaide, Perth and Coolangatta, and this is unlikely to facilitate entry on a scale sufficient to discipline the incumbents.

An extreme example of running rights would be the right to sell seats on the incumbent's aircraft. The analogy here would be swaps in the petroleum refining industry. Carriers could swap blocks of seats on various routes and price their respective blocks as they see fit. As Williamson suggested in the context of the petroleum refining industry, the swap would also attenuate the incentive to treat the other carrier's passengers poorly.[119] Indeed, to the extent that the various ground services can be swapped, the regulatory problem of ensuring an adequate standard of performance may be considerably reduced.

### Interconnection and Interswitching

The airline analogy to interconnection (and this is extreme) is to require an incumbent to provide convenient connecting flights at either the origin or destination point to be served by a new entrant. A less extreme analogy would be to prohibit an incumbent from rescheduling connecting flights solely to discourage a new entrant. Another possibility would be to oblige incumbents to allow new entrants access to their frequent flyer programs.

The analogy to interswitching would be to interline baggage, to offer joint rates for ongoing passengers and to hold flights as they would for their own interconnections where flights are intended to connect.

Airlines and railways differ in the extent of the control they exert over their respective infrastructures. Railways own virtually all their rights-of-way, trackage, terminals and other facilities. Regulatory intervention is occasionally required to ensure their availability. Airlines in Canada do not own terminal facilities. These facilities are largely government owned. Access to them is a matter of operating policy rather than regulatory intervention. The possible contribution of terminal operating policy to the contestability of individual airline routes is considered below.

### Decentralized Public and Private Responses

Public policies that might increase the contestability of monopoly air routes include:

- ensuring that arrival/departure slots, gates and ancillary facilities at government-operated terminals are available to potential entrants;
- auctioning off the rights to routes that are contestable ex ante but weakly contestable or noncontestable ex post; and
- recognizing the complementarity of airline and terminal services and other local activities, and providing incentives to reflect it in air fares.

With respect to slot availability, either time-of-day pricing or a system of tradeable slots would put entrants and incumbents on the same footing.[120] This would be true even if incumbents were grandfathered. There might still be a problem of stategic refusals to sell adjacent departure space to close rivals. This could be dealt with in several ways. The first is to reduce the strategic and, indeed, the pecuniary value of slots by expanding airport capacities. The second is to treat the monopolization of slots by a carrier or group of carriers acting jointly the same as the monopolization of any other good or service would be treated, that is, to apply the abuse of dominant position or conspiracy sections of the *Competition Act* to it. Similar considerations apply to the provision of gate space and ancillary airport facilities.

Routes which can support only one carrier and are weakly contestable *ex post* may be more strongly contestable *ex ante*. It may be possible to auction off the rights to single carrier routes. The *National Transportation Act, 1987* presently provides for the auctioning of loss-making routes under section 85(2). In this case bids compete to provide a service with the lowest possible subsidy. In the case of single-carrier profit-making routes, bids could take the form of lump-sum fees, economy fares, fare formulas or some combination thereof. Lump-sum fees could be rebated to the communities involved, perhaps credited against municipal taxes.

Route auctions would face two types of problems. The first is that property rights in routes do not exist. Having sold the right to serve it, a community could not prevent the entry of a competing carrier. One possible means by which exclusivity might be assured is by municipal control over the community airport. In this case a community could theoretically guarantee exclusivity to the winning bidder by denying landing rights to potential competitors. This type of a guarantee may not be enforceable and may not provide much comfort to the winning bidder.

The second type of problem is that auctioning off the right to serve is itself a costly process. The resources required to ensure that the winning bidder meets the commitments and to alter the contract as circumstances change can be considerable. Indeed, some authors have argued that when companies are locked in to their arrangement, the process bears a striking resemblance to conventional price, entry and exit regulation.[121]

The recognition of the existence of complementarities to air travel and the incorporation of them in fare decisions (that is, their internalization) can result in lower air fares. A simple example is the complementarity between ground services such as parking and terminal concessions, and air services. The sharing of ground service revenue with a carrier reduces its profit-maximizing monopoly fare. This principle can be extended to cover broader complementarities including the complementarity between air fares and local land values. If an air service confers value on a local industrial park or a convention centre the carrier has an incentive to set fares to encourage traffic, provided it shares in the resulting increase in value of these local assets.

Among the private-sector responses to a situation of non-contestable monopoly would be the excercise of countervailing buyer market power in various forms. One form would be corporate aviation either by charter or by corporate aircraft. A profile of the Canadian corporate fleet and carriers specializing in business charters is presented by Wallace.[122] Not surprisingly, firms in the resource sector are well represented among both aircraft owners and users of charter services. These same firms may also make extensive use of confidential contracts with scheduled carriers. At present we have no information on the importance or incidence of confidential contracts of this nature. Non-business passengers may be able to exert the same form of leverage by forming charter groups.

Among the private responses to the information problems facing travellers is the investment by carriers, tour booking companies and travel agents in their reputation. Similarly the carriers protect themselves against possible exploitation by sharing ownership of CRSs. Consumers can also take prudent actions with respect to some concerns. For example, bankruptcy is more of a threat to a traveller under the current system. A traveller can pay for a ticket with a credit card. Some issuing companies will suspend the charges while they, rather than the consumer, deal with the bankrupt carrier. Trip cancellation insurance may also help. On the other side of the transaction, many airlines in financial difficulties are forced to take precautionary steps to assuage the concerns of travellers. For example, Eastern in the United States created a $50 million escrow fund to guarantee tickets in the period before it stopped flying.

## 10. CONCLUSIONS

The domestic airline industry has changed profoundly since deregulation. There is a consensus that this change has been for the better. The power of entry, exit and pricing freedom to weed out inefficient practices has been demonstrated. At the same time the expectation of economists that city-pair airline markets would be both unconcentrated and easily entered has been disappointed. Market power is likely to exist on a number of southern Canadian routes. Deregulation constitutes a substantial improvement over the previous regime, but the close approximation to a competitive market that many of its advocates envisaged has not materialized. As a consequence, the full potential benefits of free competition have not been realized.

The fundamental policy question is whether there is a set of policies which would increase the economic benefits derived by Canadians from airline deregulation. There is a clear role for merger policy here. Specification of the precise ways in which merger or other competition policies should be applied is beyond the mandate of this study. A few general comments, however, are in order.

First, the *Competition Act* is well-suited to deal with airline mergers. Evidence of the relationship between the number of competitors and price and quality performance, while not without ambiguities and methodological problems, is both more plentiful and of higher quality than in most other markets. There is also considerable evidence regarding the source and magnitude of operating economies at the route and network levels. The analysis of the trade-off between the effects of a substantial lessening of competition and the efficiency gains resulting from an airline merger required under sections 93–96 of the *Competition Act* is likely to be more complete than in most other markets.

Second, the remedies available under the *Competition Act* could be augmented by further deregulation. The achievement of further network economies while preserving competition would be facilitated if foreign carriers could be licensed to operate on domestic routes. As it stands, there is a danger that the only available remedy will be a quasi-regulatory fix which the National Transportation Agency is arguably better qualified to impose and enforce than the Competition Tribunal. An example of a quasi-regulatory remedy is the Competition Tribunal's consent order in the *Reservec* case.[123]

There may also be a role for access policies. The most important of these are inherent in the operating procedures of the major airports. Arrival/departure slots and ancillary facilities should be priced at cost and available to incumbents and entrants on similar terms. Access to the network facilities of incumbent airlines could be enforced by the Agency. The access remedies available to railways under sections 148–152 of the *National Transportation*

*Act, 1987* may also be available to airlines under sections 77–79 of the *Competition Act*. These are the abuse of dominant position sections of the Act. The withholding of access to various network facilities to single-route entrants may be regarded as an abuse of dominant position. Similarly the Competition Tribunal may find that incumbents have an obligation to supply network facilities to entrants under section 75 of the *Competition Act*. The Agency is probably better equipped than the Tribunal to take on this task, especially if it involves ongoing supervision. An alternative is to allow for competition by other networks. This would, again, require that U.S. carriers be granted domestic licences. The resulting inter-network competition is preferable, in our view, to imposing access requirements either by means of competition or regulatory policy on a monopoly Canadian-owned network. The possibility of network competition and the formation of alliances also reduce any barrier to entry resulting from frequent flyer plans.

There is little to be said for residual fare regulation, especially under current circumstances. Regulation of the basic, or Y-fare, on monopoly routes may meet a political need. It is unlikely to have much impact on the average cost of travel on these routes. Regulation of the full slate of fare offerings is likely to be a very costly undertaking.

Finally, there may be merit in structuring the regulatory framework so that decentralized arrangements can evolve. This may involve giving individual communities the right to negotiate with potential carriers and award exclusive rights to the carrier promising the best service package. It could involve contractual arrangements which leave travel agents with the incentive to choose the lowest fare for their clients. It may also include technical innovations which make computer reservation systems more readily accessible. Regulators must ensure that they do not preclude the emergence of superior decentralized solutions to problems posed by market power.

## ENDNOTES

1. Although Canadian regulation was invasive in all these dimensions, the degree of control varied and differed from that exercised in the United States at that time:

   > A crucial feature of Canada's regulatory approach was its non-directiveness. While fare increases were disallowed from time to time as unjustified by airline costs and financial returns, and while deep discount fares were sometimes disallowed for carrying too few travel and purchase restrictions, the airlines were never told what fares they should charge instead.
   >
   > In this respect, the Canadian approach was always very different from the U.S. approach. As a result, airline pricing in Canada was determined to a greater extent than in the U.S. by airline managements, rather than by regulators. Unlike its U.S. counterpart before deregulation, the Canadian price control mechanism had no built-in incentives to the airlines to provide excess capacity. (Hans Lovink, "When to Deregulate the Airline Industry: Canada's Approach" in Bureau of Transport Economics, *Economic Regulation of Aviation in Australia, Seminar Papers and Proceedings* (Australian Government Publishing Service, 1985), p. 96.)

2. The Committee endorsed the thrust of the position paper, offering suggestions for details in implementation in its Sixth Report, entitled *Freedom to Move: Change, Choice, Challenge*, Ottawa, 1985.

3. Richard M. Soberman, "Canadian Passenger Transportation Policy," in *Canadian Transportation Policy*, edited by David W. Gillen (Kingston: Queen's University, John Deutsch Institute, 1990), p. 8.

4. Starting at the west coast, the dividing line follows the 55th parallel until Manitoba which it crosses at a diagonal until it reaches the 50th parallel. From this point east the boundary follows the 50th parallel.

5. According to section 67 of the Act this percentage can be reduced by the Governor in Council.

6. CP Air began with "Courieur" fares and followed with "Skybus" fares. AC countered with "Nighthawk" and the "One Way/One Day Skysave" programs.

7. Earl Thompson in "The Perfectly Competitive Production of Collective Goods," *Review of Economics and Statistics* 50 (1968), pp. 1–12 and Harold Demsetz in "The Private Production of Public Goods," *Journal of Law and Economics* 13 (1970), pp. 293–306 reached different conclusions on this matter. The two views are reconciled in Thomas Borcherding, "Competition, Exclusion, and the Optimal Supply of Goods," *Journal of Law and Economics* 21 (1978), pp. 111–32. The Thompson view depends on discrimination being maintained in the face of competition. This debate is related to that which distinguishes between the nature of competition among rivals providing the goods. The outcome will have desirable properties if the competition to sign up the customers is Bertrand competition. If the competition is Cournot, competitive entry will be excessive. See Daniel F. Spulber, *Regulation and Markets* (Cambridge, Mass.: The MIT Press, 1989), p. 42 and references cited there. (See section 6 of this report for an explanation of "Bertrand" and "Cournot" competition.)

8. See T. E. Duffy and P. R. Berlinguette, *The Low-Priced Air Fare Review: The First Five Years* (Canadian Transport Commission, Research Branch, 1983/05e, November 1983).

9. Alfred E. Kahn, "Applications of Economics to an Imperfect World," *American Economic Review* 69 (May 1979), pp. 11–12.

10. Alfred E. Kahn, "Surprises of Airline Deregulation," *American Economic Review* 78, no. 2 (May 1988), p. 320.

11. E. E. Bailey, and J. R. Williams, "Sources of Economic Rent in the Deregulated Airline Industry," *Journal of Law and Economics* 31 (1988), p. 188. © 1988 by The University of Chicago. All rights reserved. 0022-2186/88/3101-0006 $01.50.

12. As described in Geoffrey Rowan, "Airlines try to lure bargain travellers," *The Globe and Mail* [Toronto] May 17, 1991, pp. B1 and B2.

13. Charters still play a role, although a diminishing one, in the Toronto–Vancouver run. See the National Transportation Agency, *Annual Review 1989* (Ottawa: Supply and Services Canada, 1990) p. 42.

14. "How Airlines Deregulation Can Mean Dollar Savings for Business Travelers," *Dun's Business Month*, April 1985, p. 81.

15. *The Globe and Mail*, [Toronto], February 12, 1991, p. C1.

16. The National Transportation Agency *Annual Review 1989*, p. 43 reported: "On 32 routes which Air Canada and Canadian turned over to their regional affiliate airlines, the number of discount fares more than doubled in 1988 and remained at this level in 1989, averaging over eight per route."

    With reference to the availability of discounts on short-haul versus long-haul flights:

    > In 1986, discount carriage on long-haul services in the southern domestic market represented 66.7% of passenger volume and 67.6% of passenger-kilometres; this compares with 50.7% and 52.5% respectively for short-haul. This distinction was even more pronounced in the preceding three years. Statistics Canada, *Touriscope, 1988 Tourism in Canada: A statistical digest* (Ottawa: Supply and Services Canada, Catalogue No. 87-401, October 1988), p. 110.

17. Statistics Canada, *Air carrier operations in Canada: October-December 1989* (Supply and Services Canada, Catalogue No. 51-002, vol. 20, no. 4, December 1990), Figure 1, p. xi.

18. Samuel Skinner, U.S. Secretary of Transportation, *Airline Marketing Practices: Travel Agencies, Frequent-Flyer Programs, and Computer Reservation Systems.* A study of the Task Force on Competition in the U.S. Domestic Airline Industry, (Washington, D.C.: U.S. Department of Transportation, 1990), p. 31.

19. Information from an interview (October 19, 1990) with Roger Roy of the National Transportation Agency of Canada.

20. Samuel Skinner, *Airline Marketing Practices*, pp. 8 and 9.

21. "AT&T has stated that its auditing service saved the corporation $700,000 a year even though the company's agency failed to book the lowest fare only two percent of the time." Ibid., p. 18.

22. Guerin-Calvert notes: "CAB found that the U.S. CRSs systematically used their market power in CRS to limit the ability of new entrants (carriers either new to the industry or to dominated markets) to get their lower fares to the public, that new carriers' costs were

increased, and that customers paid substantially higher prices for airline service than they would have paid in the absence of CRS market power." See Margaret E. Guerin-Calvert, "Competitive Analysis of the Reservec-Pegasus Merger," March 2, 1989, Affidavit submitted by Director of Investigation and Research, Bureau of Competition Policy to the Competition Tribunal, Ottawa, in the *Gemini* case, p. 37.

23. Kenneth W. Thornicroft, "Airline Deregulation and the Airline Market," *Journal of Labor Research*, 10, no. 2 (Spring 1989), p. 166.

24. Thomas G. Moore, "U.S. Airline Deregulation: Its Effects on Passengers, Capital, and Labor," *Journal of Law and Economics*, 29 (1986), p. 26.

25. Bailey and Williams, "Sources of Economic Rent," p. 193.

26. Jordan has argued that, despite the agitation in 1979 and 1980, a longer perspective indicates that strikes/lockouts played a smaller role in the U.S. in the first six years of deregulation than they did in the last four years of regulation. William A. Jordan, "Results of U.S. Airline Deregulation: Evidence from the Regulated Canadian Airlines," *Logistics and Transportation Review* 22, no. 4 (1986), p. 325.

27. *The Vancouver Sun*, December 1, 1989, pp. C1 and C5.

28. *The Globe and Mail*, [Toronto] October 10, 1990, pp. B1 and B2.

29. Ibid., October 13, 1990, pp. B1 and B2.

30. Jean-François Bence, "La déréglementation du transport aérien," *Policy Options Politiques* 11, no. 2 (March 1990), p. 15.

31. Kahn, "Surprises of Airline Deregulation," p. 319.

32. National Transportation Agency of Canada, *Annual Review 1989*, Figure 3.9, p. 42.

33. John R. Meyer and Clinton V. Oster Jr., *Deregulation and the Future of Intercity Passenger Travel* (Cambridge, Mass.: The MIT Press 1987), p. 124.

34. Moore, "U.S. Airline Deregulation", p. 21.

35. Steven A. Morrison and Clifford Winston, "Enhancing the Performance of the Deregulated Air Transportation System," in *Brookings Papers on Economic Activity: Microeconomics*, edited by M.N. Baily and C. Winston (Washington, D.C.: The Brookings Institution, 1989), p. 73.

36. The potential of hub-and-spoke architecture was realized before deregulation but its introduction required the freedom to realign routes which deregulation provided. A reference for an engineering description of the advantages of hubbing is Adib Kanafani, "Aircraft Technology and Network Structure in Short-Haul Air Transportation," *Transportation Research 305*, 15A, (1981). An early discussion of the economics appears in Arthur S. De Vany and Eleanor H. Garges, "A Forecast of Air Travel and Airport Use in 1980," *Transportation Research* 6, 1 (1971). In conversation with the authors, George Hariton, who was formerly the Director of Research at the Canadian Transport Commission, noted that Boeing was an important force in developing the hub-and-spoke system.

37. *Flight International*, June 3, 1989, pp. 29–32.

38. To gain perspective on Toronto's North American status as an airport, it is worth noting that in 1988 it was the 21st busiest airport in the world on the basis of passengers embarked and the 20th busiest on the basis of aircraft movements. International Civil Aviation Organization, *Civil Aviation Statistics of the World 1988*, DOC 9180/14 (1989), pp. 150–51.

39. Statistics Canada, *Touriscope, 1988 Tourism in Canada: A statistical digest*, p. 107.

40. As quoted by Lovink, pp. 99–100.

41. David W. Gillen, T. H. Oum and M. W. Tretheway, "Airline Cost Structure and Policy Implications," *Journal of Transport Economics and Policy* (January 1990), p. 28. What is considered a cost factor or a demand factor depends on the definition of output. Gillen et al. felt that such factors as frequency of flights and more attractive frequent flyer programs, affect demand. We view these as elements of quality which the smaller producer finds more costly to provide.

42. Douglas W. Caves, Laurits R. Christensen and Michael W. Tretheway, "Economies of Density Versus Economies of Scale: Why Trunk and Local Service Airline Costs Differ," *Rand Journal of Economics* 15, no. 4 (Winter 1984).

43. Jordan, "Results of U.S. Airline Deregulation," p. 301.

44. David R. Graham and Daniel P. Kaplan, *Competition and the Airlines: An Evaluation of Deregulation*. Staff Report of the Office of Economic Analysis, Civil Aeronautics Board (Washington, D.C.: December 1982), p. 46.

45. Gillen, Oum and Tretheway, "Airline Cost Structure," n. 15.

46. In the United States, the exception is Southwest Airlines, which has been successful and is expanding. However, it has stuck to a regional strategy, adopted point-to-point scheduling rather than a hub configuration, and has not chosen to compete directly with the major carriers on the main routes between large cities.

47. Kahn, "Surprises of Airline Deregulation," p. 318. Kahn is perhaps unique in organizing the demise of the regulatory body, the Civil Aviation Board, which he headed.

48. Before the strike there were 17,725 controllers of which 13,300 were full-time. In March 1987 there were 14,900 controllers of which 11,200 were full-time.

49. The controlled airports currently are Chicago O'Hare, Washington National and Kennedy and LaGuardia in New York.

50. "During the worst two-day period in December, 111 flights into or out of Pearson were cancelled, causing disruption of air traffic from coast-to-coast." National Transportation Agency of Canada, *Annual Review 1988*, p. 50.

51. Garth Wallace, "Living with Slots," *Aviation and Aerospace* (January 1990), p. 51.

52. Robert W. Hahn and Randall S. Kroszner, "The Mismanagement of Air Transport: A Supply-Side Analysis," *The Public Interest* 95 (Spring 1989), pp. 105–106.

53. Slots not used 65 percent of the time in a two-month period are withdrawn by the FAA; international slots are not covered by the rule.

54. See Table B-4 of Samuel Skinner, U.S. Secretary of Transportation, *Airports, Air Traffic Control, and Related Concerns (Impact on Entry)*. A study of the Task Force on Competition in the U.S. Domestic Airline Industry, (Washington, D.C.: U.S. Department of Transportation, 1990).

55. Ibid., p. 2-9.

56. Ibid., p. 2-17.

57. Ibid., p. 2-15.

58. National Transportation Agency of Canada, *Annual Review 1989*, p. 27.

59. Morrison and Winston, "Enhancing the Performance," p. 93.

60. *The Globe and Mail*, [Toronto], November 20, 1990.

61. National Transportation Agency of Canada, *Annual Review 1989*, pp. 38, 40.

62. Moore, "U.S. Airline Deregulation," p. 27.

63. T. H. Oum, W. T. Stanbury and M. W. Tretheway, "Airline Deregulation in Canada and its Economic Effects," Working Paper #90-TRA-013, Draft, June 29, 1990, p. 19.

64. *The Globe and Mail*, [Toronto], October 12, 1990, pp. A1 and A2.

65. National Transportation Agency of Canada, *Annual Review 1989*, p. 30.

66. "Service levels in Canada's top 20 city-pairs increased substantially during the year, as evidenced by a 14 per cent increase in the number of direct flights and a 24 per cent increase in the seat capacity offered (fourth quarter 1988 versus fourth quarter 1987)." National Transportation Agency of Canada, *Annual Review 1988* (Ottawa: Supply and Services Canada, 1989) p. 57.

67. Oum, Stanbury and Tretheway, "Airline Cost Structure," Exhibit 5.

68. Federal Trade Commission, *The Deregulated Airline Industry: A Review of the Evidence* (1988) n. 3, p. 10.

69. National Transportation Agency of Canada, *Annual Review 1989*, p. 30

70. Ibid., p. 55.

71. Ibid., pp. 29–30.

72. Bence, "La déréglementation," p. 16.

73. An s-curve describes the relationship between carrier capacity and revenue on a route. Presumably, more frequent flights increase the value of a ticket on any one flight since they give more options should customers have to make adjustments in their travel times and because of frequent flyer programs.

74. From an Exhibit in the USAir–Piedmont Merger Case, July 1987 as cited in Severin Borenstein, "On the Efficiency of Competitive Markets for Operating Licences," *Quarterly Journal of Economics* 103 (1988), p. 357.

75. Kahn, "Surprises of Airline Deregulation," p. 318.

76. Lawrence F. Cunningham, M. B. Slovin, W. R. Wood and Janis K. Zaima, "Systematic Risk in the Deregulated Airline Industry," *Journal of Transport Economics and Policy*, (September 1988), p. 347.

77. Thomas Moore reported in "U.S. Airline Deregulation: Its Effects on Passengers, Capital, and Labor," "In spite of the bankruptcy of Braniff and the poor economic performance of Continental, TWA, and Western, the real value of the ten trunk airlines, including Pan Am, has remained virtually unchanged from December 1, 1976, to December 1, 1983. For comparison, real value of all stocks on the New York Stock Exchange fell 3 percent over the same period. Some airlines, such as American, which tripled in value, did very well in this new unregulated market, as measured by the stock value of the company. But the big gainers were the regional carriers. The thirteen regional carriers witnessed the value of their companies balloon almost sixfold in real terms."

78. See "Airlines fly towards financial abyss," *The Ottawa Citizen*, June 19, 1990, p. D7.

79. Fred Lazar, in his *Deregulation of the Canadian Airline Industry: a Charade* (Toronto: Key Porter Books, 1984), p. 46, stated:

> Pricing wars and destructive competition are to be expected in an industry in which all firms produce identical products, there is no dominant price leader, fixed costs comprise the largest share of total costs and demand declines.

80. Lee J. Van Scyoc, "Effects of Airline Deregulation on Profitability," *The Logistics and Transportation Review* 25, no. 1 (March, 1989), p. 48.

81. The margin is the difference between operating revenues and operating expenses (excludes depreciation and interest charges).

82. Level I airlines are the larger carriers. From 1981 to 1986 the class included AC, CP, EPA, Nordair, Quebecair, PWA and Wardair. In 1988, AC, CAIL and Wardair represented the class. Currently there are two Level I carriers, AC and CAIL.

83. See G. J. Stigler, "A Theory of Oligopoly," *Journal of Political Economy* 72, no. 1 (February 1964), pp. 44–61.

84. The model employed here is an address model in which carriers have different locations in "departure space" but are otherwise identical. For a general discussion of address models see Steven Salop, "Monopolistic Competition with Outside Goods," *Bell Journal of Economics* 10, (1979), pp. 141–56.

85. See for example National Transportation Agency of Canada, Staff Report, File Number DR-88 3004, Appendix III, (1988), p. 5.

86. Joseph A. Schumpeter, *Capitalism, Socialism and Democracy* (New York: Harper & Row, Torchbook edition, 1962), p. 85.

87. With increasing average costs, the incumbent could not prevent a subset of customers from signing up with an entrant, and the break-even price is not sustainable. However,

within the capacity of an airplane, average costs per passenger decline, and the carrier's break-even price would be sustainable.

88. Technically, sustainability in this context means that the charges to each group must be in the core of the price game. It is conceivable that the core is empty, but the more likely outcome is that more than one assignment will be in the core. Under quite general circumstances Ramsey prices (prices which maximize welfare subject to a break-even constraint) are in the core.

89. Soberman, "Canadian Passenger Transportation Policy," p. 5.

90. Robert W. Hahn and Randall S. Kroszner, "The Mismanagement of Air Transport: A Supply-Side Analysis," *The Public Interest* 95 (Spring 1989), p. 105.

91. Lazar, *Deregulation*, p. 137.

92. Michael W. Tretheway, "Analysis of the Effect of the Gemini Computer Reservation System Merger on Competition in the Canadian Airline Industry," (March 1, 1989). Affidavit submitted by Director of Investigation and Research, Bureau of Competition Policy in the *Gemini* case, p. 19. Note that CAIL has only purchased a minority interest in its feeders.

93. Ibid.

94. The average round trip was 1,179 miles. Morrison and Winston, p. 67 and n. 15.

95. David W. Gillen, W. T. Stanbury and Michael W. Tretheway, "Duopoly in Canada's Airline Industry: Consequences and Policy Issues," *Canadian Public Policy* 14(1) (March 1988), p. 27.

96. Morrison and Winston, "Enhancing the Performance," p. 83 and fn. 44.

97. Ibid., p. 67.

98. The European and American codes cover display bias, pricing, contract length, terms and conditions of contracts, and provide non-discriminatory access to enhancements such as direct access links. Margaret E. Guerin-Calvert, "Competitive Analysis," p. 46.

99. Michael E. Levine, "Evidence," (March 1, 1989), submitted by Director of Investigation and Research, Bureau of Competition Policy to the Competition Tribunal, Ottawa, in the *Gemini* case, p. 16.

100. Skinner, *Airline Marketing Practices*, p. 6.

101. Bailey and Williams, "Sources of Economic Rent," p. 189.

102. Skinner, *Airline Marketing Practices*, p. 15.

103. See *The Globe and Mail* [Toronto], December 15, 1989, p. B6.

104. Asra Q. Nomani. "Fare Game: Airlines may be Using a Price-Data Network to Lessen Competition," *Wall Street Journal* [New York], June 28, 1990, p. A1.

105. Kahn, "Surprises of Airline Deregulation," p. 319.

106. R. D. Willig and W. J. Baumol, "Using Competition as a Guide," *Regulation* (1987), no. 1, pp. 28–35.

107. M. J. Roberts, "Residual Rate Control: The Unmet Challenge of Deregulation, *The Logistics and Transportation Review* 23, 1 (1987) pp. 83–108.

108. F. Dunbar, and J. Mehring, "Coal Rail Prices During Deregulation: A Hedonic Price Analysis," *The Logistics and Transportation Review* 23, 1 (1987) pp. 17–34.

109. Roberts, "Residual Rate Control," n. 107.

110. R. Lande, *Railway Law and the National Transportation Act* (Toronto: Butterworths, 1989), pp. 140–41.

111. Canadian Transport Commission, Decision number MV-40-224 (MV-86-1) (Ottawa, 1986).

112. Ibid., p. 35.

113. Morrison and Winston, "Enhancing the Performance," pp. 61–112.

114. Ibid., p. 74.

115. Morrison and Winston found that, other things being equal, fares were higher on routes where either the origin or the destination was the hub of a major carrier. See Morrison and Winston, ibid., p. 74. Others dispute the proposition that routes involving hubs are particularly difficult to enter. See "The Myth of the Fortress Hub," *The Avmark Aviation Economist* (October 1990), pp. 6–9.

116. National Transportation Agency of Canada, *Annual Report 1990* (Ottawa: Supply and Services Canada, 1991), p. 20.

117. Lande, *Railway Law and the National Transportation Act*, p. 147.

118. P. Flint, "Toto, I have a feeling we're not in Kansas anymore," *Air Transport World* (May 1990), pp. 52–59.

119. O. E. Williamson, "Credible Commitments Using Hostages to Support Exchange," *American Economic Review* 73 (September 1983), pp. 519–40.

120. Borenstein has pointed out that if bidders in a slot market differ in their ability to capture surplus slots, the free market allocation of slots may not maximize total surplus. This need not imply any asymmetry between incumbents and entrants. See S. Borenstein, "On the Efficiency of Competitive Markets for Operating Licenses," *Quarterly Journal of Economics* 103 (May 1988), pp. 357–85.

121. See O. E. Williamson, "Franchise Bidding for natural monopolies — in general and with respect to CATV," *The Bell Journal of Economics* 7 (Spring 1976), pp. 73–104.

122. See G. Wallace, "Flying for Business," *Canadian Aviation* (October 1989), pp. 23–31.

123. The Consent Order specifies detailed rules for the display of flight information on computer reservation systems and for the relationships between these systems and carriers and subscribers respectively. See "In the matter of an application by the Director of Investigation and Research under subsection 64(1) of the *Competition Act*, R.S.C. 1970, c. C-23, as amended; Consent Order (Competition Tribunal, CT - 88 / 1).

## 9

# CONSTITUTIONAL JURISDICTION OVER TRANSPORTATION: RECENT DEVELOPMENTS AND PROPOSALS FOR CHANGE

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## I. INTRODUCTION

The purpose of this study is twofold: to provide an overview of constitutional jurisdiction in the field of transportation, and to consider the need for constitutional change in this field.

The study examines the relevant provisions in the Canadian Constitution allocating jurisdiction over the field of transportation,[1] and considers the judicial interpretation of these provisions and the extent to which the courts have modified or supplemented the original scheme contemplated by the Constitution. It then examines how legislative jurisdiction has actually been exercised by both federal and provincial governments to establish whether the constitutional division of responsibilities has limited or constrained the ability of governments to respond to changing circumstances in transportation.

This analysis leads logically to the second purpose of the study — a consideration of the need for constitutional change in the field of transportation. Does the existing constitutional scheme require amendment? Such an analysis is timely, given the current constitutional discussions that are ongoing in

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Canada. In September of 1991, the Government of Canada initiated a process aimed at a fundamental and comprehensive re-examination of the Canadian Constitution.[2] In addition to the proposals put forward by the government, there have been a variety of other suggestions for fundamental constitutional change published over the past year.[3] Many have included proposals for change to the constitutional allocation of jurisdiction over transportation. It is important that the debate over such changes be grounded in a detailed and concrete understanding of the existing scheme of the Constitution; it is also important to identify with some care the possible implications of any proposed constitutional amendments. This study will attempt to provide such an understanding.

The first section of the paper outlines the existing constitutional jurisdiction in the field of transportation. Since this is an area that has been discussed quite extensively in the academic literature,[4] the emphasis here is on recent developments, particularly the recent Supreme Court of Canada judgements which have clarified the respective roles and responsibilities of the federal and provincial governments in relation to transportation. This section outlines the various provisions in the Constitution which grant federal or provincial jurisdiction over transportation and reviews the regulatory framework which both levels of government have put in place on the basis of their constitutional responsibilities. Finally, it identifies the issues or areas which can be expected to generate litigation in the future, as reflected by an analysis of recent court decisions.

The first issue discussed in the second section of this study is whether the existing constitutional framework has led to any obvious problems or difficulties. The study examines the extent to which the current constitutional framework may have prevented governments or the private sector from responding to changing needs or circumstances in transportation. It also analyzes the extent to which the Constitution may impede government as it faces the challenges inherent in designing a transportation system that will meet future needs of Canadians.[5]

The second section of the paper also considers the merits and implications of a variety of proposals to change constitutional responsibilities in relation to transportation. Over the last year, the Constitutional Committee of the Quebec Liberal Party (The Allaire Committee),[6] the Group of 22,[7] as well as the Government of Canada,[8] have all put forward proposals for altering the

Constitution as it relates to transportation. This section also considers the extent to which the existing Constitution permits governments to delegate or alter regulatory responsibility in the transportation field.[9] The paper concludes with an overall assessment of the need for formal constitutional amendments in the field.

## II. THE EXISTING CONSTITUTIONAL FRAMEWORK

The *Constitution Act, 1867* does not classify transportation as a class of subject (or head of power) assigned exclusively to Parliament or the provincial legislatures. Instead, specific transportation matters or modes are dealt with in a variety of separate constitutional provisions which effectively divide responsibility for transportation regulation between the federal and provincial governments. In general terms, the Act allocates jurisdiction over interprovincial and international transportation to the federal government, while reserving to the provinces responsibility for transportation matters within a single province. This territorial approach to transportation[10] is reflected most clearly in section 92(10) of the *Constitution Act, 1867*, which reserves to the federal Parliament responsibility over "Works and Undertakings connecting the Province with any other or others of the Provinces, or extending beyond the Limits of the Province,"[11] while providing for provincial responsibility for "Local Works and Undertakings."

Other provisions in the 1867 Act which allocate jurisdiction to the federal Parliament include sections 91(9) ("Beacons, Buoys, Lighthouses, and Sable Island"); 91(10) ("Navigation and Shipping"); 91(13) ("Ferries between a Province and any British or Foreign Country or between Two Provinces"); section 92(10)(c) (power to declare local works for the "general Advantage of Canada"); and section 108 (certain Public Works and Property of each Province was transferred to Canada, including Canals, Public Harbours, Railways and Military Roads).[12] The federal power over "trade and commerce" in section 91(2) of the 1867 Act was at least potentially relevant to the field of transportation. The courts have construed this provision narrowly, however, and it has never been interpreted as adding significantly to federal authority in this field.[13] Federal authority over criminal law in section 91(27) has also permitted the federal government to establish a set of criminal prohibitions and sanctions relating to the operation of motor vehicles, vessels and aircraft.[14] Provincial authority in relation to transportation matters flows from section 92(10) ("Local Works and Undertakings"); section 92(13) ("Property and Civil Rights in the Province"); and section 92(16) ("Matters of a merely local or private Nature in the Province").

The courts have also been called upon to supplement the original division of powers contemplated by the 1867 Act as new modes or methods of transportation arise. Of greatest significance in this regard is air travel which of course was unknown in 1867 and was therefore not mentioned in the original division of powers. The courts have interpreted the federal Parliament's power to make laws for the "Peace, Order and good Government of Canada" as including the exclusive authority to regulate all aspects of air travel.

The terms of section 92(10), establishing federal jurisdiction over interprovincial works and undertakings, have been the greatest single source of constitutional litigation in the field of transportation. The principles which the courts have developed in their interpretation of this provision make up the essential core of the constitutional jurisprudence in the transportation field.

## JURISDICTION OVER WORKS AND UNDERTAKINGS

Section 92(10) of the *Constitution Act, 1867* provides that the provincial legislatures have exclusive power to make laws in relation to:

> Local Works and Undertakings other than such as are of the following Classes: —
>
> (a) Lines of Steam or Other Ships, Railways, Canals, Telegraphs, and other Works and Undertakings connecting the Province with any other or others of the Provinces, or extending beyond the Limits of the Province:
>
> (b) Lines of Steam Ships between the Province and any British or Foreign Country:
>
> (c) Such works as, although wholly situate within the Province, are before or after their Execution declared by the Parliament of Canada to be for the general Advantage of Canada or for the Advantage of Two or more of the Provinces.

Although section 92(10) is in terms a grant of legislative power to the provinces, the exceptions established in subsections (a), (b) and (c) have proven to be the most significant feature of the provision. These exceptions from provincial authority represent grants of exclusive legislative authority to the Parliament of Canada, in accordance with section 91(29) of the *Constitution Act, 1867*.

There are a number of settled principles with regard to the interpretation of section 92(10). The first relates to the distinction between "Works" and "Undertakings" referred to in the provision. The courts have interpreted an "Undertaking" as involving both a physical and an organizational element. Viscount Dunedin in the *Radio Reference* referred to an undertaking as "not a physical thing, but . . . an arrangement under which . . . physical things are used."[15] Thus, in the *Winner* case, the federal Parliament possessed jurisdiction not only over the buses which provided the interprovincial transportation, but also over the bus company itself.[16] This functional approach means that federal authority over interprovincial undertakings extends to all aspects of the organization or enterprise which provides the service in question.

A second settled principle has to do with the fact that constitutional jurisdiction over a particular work or undertaking is to be undivided: for the purposes of section 92(10) jurisdiction is allocated to a single level of government. The courts have consistently rejected the idea of dividing jurisdiction between the federal and the provincial governments over a single undertaking. This fundamental principle was first established in the *Bell Telephone* case of 1905.[17] The Privy Council rejected the idea that the telephone company's long-distance business and its local business should be separated for the purpose of allocating legislative jurisdiction. The Board held that the telephone company was engaged in an interprovincial undertaking and thus the whole of the company's business, including its strictly local activity, fell under federal jurisdiction.

This approach is quite different from that adopted by the Privy Council in relation to its interpretation of the federal trade and commerce power in section 91(2) of the *Constitution Act, 1867*. It consistently restricted the federal authority over trade and commerce to the interprovincial or international aspects of trade; the local aspects of trade remained subject to exclusive provincial jurisdiction and could not be reached by federal legislation. Thus, in the *Natural Products Marketing Reference* (1937),[18] a federal statute regulating natural products that were primarily traded in international markets was ruled invalid since the statute included some transactions which could be completed within a single province. The reasoning of the Privy Council was that federal authority could only be exercised in relation to those transactions which crossed provincial borders. This segmented approach to the construction of the trade and commerce power has proven to be one of the key factors in limiting the scope and usefulness of this particular source of federal authority.[19]

On the other hand, the Privy Council's determination that jurisdiction over transportation undertakings was to be undivided has led to quite different results in the transportation field. Once an undertaking is classified as interprovincial, federal jurisdiction immediately extends to all aspects of the enterprise, including any features that are strictly local. This has meant that federal authority to regulate transportation undertakings has been much more extensive and therefore more effective than in many other areas of federal jurisdiction. In particular, the Privy Council's undivided approach to transportation undertakings has meant that this is one of the few areas in which the federal government is capable of effective action without the necessity of involving provincial governments.[20]

The courts' resistance to dual jurisdiction in the transportation field has had important implications in the central issues which have emerged in litigation surrounding section 92(10). The allocation of jurisdiction has been treated by the courts as "an all or nothing affair";[21] a transportation undertaking is subject *either* to federal jurisdiction or to provincial jurisdiction, but not simultaneously to both. This has meant that the key question for purposes of section 92(10) has been the characterization of an undertaking as either local or interprovincial. This, in turn, has led to two recurring questions that continue to dominate the court decisions in this area:

1. What is the extent of the interprovincial activity or connection that is necessary to support a finding that a given undertaking is interprovincial or international as opposed to local?
2. To what extent can federal jurisdiction be extended to an otherwise purely local undertaking because that local undertaking is functionally integrated or connected with an interprovincial undertaking?

## INTERPROVINCIAL WORKS AND UNDERTAKINGS

The courts have established a relatively low threshold of interprovincial activity to support a finding that a particular undertaking qualifies as an interprovincial one. The courts have consistently held that an undertaking falls within federal regulatory authority even if only a small percentage of its business activity is interprovincial or international. The primary test is whether the interprovincial or international services are a "continuous and regular" part of the undertaking's operations. If this requirement is met, then the whole undertaking is subject to exclusive federal regulation.

There are many examples of this rule being applied so as to include primarily local undertakings within federal jurisdiction. In the case of *Re Tank Truck Transportation* (1960),[22] the issue was whether the *Ontario Labour Relations Act* was applicable to an Ontario trucking company whose operations were predominantly confined to the province of Ontario. The evidence before the Court was that, in 1959, the trucking firm had completed 94 percent of its trips within the province, with just 6 percent extending beyond provincial borders. But the Court found that the interprovincial activity was a "continuous and regular" aspect of the trucking firm's operations and, as a result, the whole of the undertaking, including the local operations within Ontario, was subject to the exclusive authority of the Parliament of Canada.[23] A similar ruling was made in the *Liquid Cargo* case (1965),[24] where only 1.6 percent of a trucking firm's trips extended beyond provincial boundaries.

The most recent Supreme Court of Canada pronouncement on this issue was made in *Alberta Government Telephones v. Canadian Radio-television and Telecommunications Commission and CNCP Telecommunications*.[25] The question here was whether Alberta Government Telephones (AGT), a provincial Crown corporation operating a telephone system in Alberta, fell under federal or provincial authority. AGT's physical facilities were located entirely within the province of Alberta and the system could carry telephone messages only within the province. However, the AGT system was connected with other telephone companies outside the province to enable local subscribers to make extra-provincial telephone connections. AGT argued that it fell under provincial regulatory authority since its activities were confined totally to the territory of the province of Alberta. The Supreme Court unanimously rejected this claim, holding that AGT was subject to exclusive federal authority.[26] In reaching this conclusion, the Court articulated a number of general principles that it indicated ought to guide analysis of this issue:

1. The location of the physical apparatus of an undertaking in a single province and the fact that all the recipients of a service are within a single province will not preclude a finding that an undertaking is interprovincial in scope. The primary concern is "not the physical structures or their geographical location, but rather the service which is provided by the undertaking through the use of its physical equipment."[27]
2. In considering the nature of the service or operation, one must look to the "normal or habitual activities of the business as those of 'a going concern', without regard for exceptional or casual factors. . . ."[28]
3. It is impossible to formulate in the abstract a single comprehensive test which will be useful in all cases; instead, the court must be guided by the "particular facts in each situation. . . ."[29]

Applying these principles to the situation of AGT, the Court found that the operations of the Crown corporation were interprovincial and international in scope. The primary basis for this conclusion seemed to be that AGT provided a service which enabled residents of Alberta to communicate beyond the borders of the province. According to Chief Justice Dickson, who wrote for the Court on this point, "AGT is, through various commercial arrangements of a bilateral and multilateral nature, organized in a manner which enables it to play a crucial role in the national telecommunications system."[30] It was the capacity to provide this extra-provincial service which supported the finding that AGT was subject to exclusive federal authority.

One leading commentator, Professor P. Hogg, has observed that this represents a more expansive reading of federal authority than has been adopted in other contexts.[31] As he has pointed out, the fact that a local undertaking is capable of providing a service beyond the borders of a single province had previously been regarded as an insufficient basis for asserting federal regulatory jurisdiction. For example, in the *Cannet Freight Cartage* case,[32] a freight forwarder provided local customers with the opportunity to ship goods beyond the borders of the province. The freight forwarder took delivery of goods in one province and made all the arrangements necessary to ship the goods to another province by rail. The Ontario Court of Appeal found the freight forwarder to be subject to exclusive provincial jurisdiction because its own operations were limited to a single province. The Court reasoned that the freight forwarder did not become an interprovincial undertaking by virtue of shipping goods on an interprovincial railway.

Professor Hogg has expressed the view that it is not easy to see a difference in the facts that make up the *AGT* case and those of earlier cases such as *Cannet Freight*. He has suggested that what might explain the Supreme Court's most recent decision was the sheer scope and complexity of the agreements between AGT and the other Canadian telephone companies. These multilateral agreements meant that AGT was part of what amounted to an integrated national telecommunications network.[33] What seems evident, in any event, is that the Supreme Court was prepared to take a slightly broader view of federal regulatory authority in this case than it had previously. It is also significant that the Court was prepared to move in the direction of greater federal authority in an area which had traditionally been subject to control by the provinces.

Historically, federal regulatory authority had included Bell Canada (serving Ontario and Quebec), the British Columbia Telephone Company, as well as telephone companies serving Yukon, the Northwest Territories and parts of Newfoundland.[34] But the telephone companies in the other provinces had traditionally been subject to provincial or local control.[35] Thus, in a practical sense, the Court's decision in *AGT* had quite significant practical implications. It opened the door for federal regulatory authority in a context which had traditionally been regarded as subject to exclusive control of the provinces.[36]

## INTEGRATION OF LOCAL AND INTERPROVINCIAL UNDERTAKINGS

As noted, a transportation undertaking can be classified as federal if the undertaking itself is regarded as interprovincial (as in the *AGT* case), or if a purely local undertaking is integrated or connected with another undertaking which is itself interprovincial.

The precise degree of the connection or integration that is required has been the subject of extensive litigation over the years. An early Privy Council case determined that mere physical connection between a local railway and an interprovincial railway was insufficient to bring the local railway under federal authority.[37] Integration in an operational or functional sense is required before local undertakings fall within federal authority. For example, a local railway line that was operated under a formal management agreement by the CNR was held to fall within federal authority.[38] Similarly, a company supplying stevedore services in Toronto to seven shipping companies involved in international shipping was held to be subject to federal labour legislation.[39] Although the stevedore company was independent of the shipping companies, the services which it provided were integral to the successful operation of the shipping enterprises. The same reasoning was applied in the *Letter Carriers* case,[40] in which a trucking company which had contracted with the Post Office to deliver and collect mail was found to be within federal authority. The Court found that the trucking operation was integral and necessary to the operations of the Post Office itself.

The most recent Supreme Court of Canada judgement on this issue is the *Central Western Railway* case.[41] The issue here was whether Central Western Railway, a small railway located entirely within the province of Alberta, fell within federal or provincial jurisdiction. Central Western used its 105 miles of track in central Alberta to transport grain from nine elevators to the CNR's interprovincial rail line. The grain cars were then transported by CN to Vancouver for export. Central Western's tracks were separated from those of CN by a four-inch gap, and the CNR controlled the device which regulated entry onto its line. The issue for the Court was whether the degree of connection and integration between Central Western and CNR was sufficient to subject the local railway to federal jurisdiction.

Chief Justice Dickson, speaking for a majority of the Court,[42] rejected the argument that Central Western could be regarded itself as an interprovincial railway, noting that mere physical connection between a local and an interprovincial rail line was an insufficient basis for establishing federal jurisdiction. He cited the *AGT* case, arguing that "[t]he linchpin in the *AGT v. C.R.T.C.* decision was this court's finding that AGT, by virtue of its role in Telecom Canada and its bilateral contracts with other telephone companies, was able to provide its clients with an interprovincial and, indeed, international telecommunications service."[43] The Chief Justice regarded Central Western's operation as quite different from that of AGT. He noted that Central Western simply moved grain within Alberta and that the interprovincial transportation of grain was handled entirely by CN. On this basis, he concluded that Central Western was a local railway and not itself part of an interprovincial undertaking.

The Chief Justice then turned to the second possible basis for finding in favour of federal authority. Even though Central Western was a local railway, it would fall under federal authority if it could be characterized as an integral part of a federal work or undertaking. Dickson C. J. indicated that this integration migh[illegible]lop in at least two different ways.[44] First, the management and operation of Central Western might be coordinated or undertaken in common with that of an interprovincial undertaking. Second, the effective operation of a federal undertaking might be dependent on the services of Central Western.

Dickson C. J. concluded that Central Western was not functionally integrated with any interprovincial undertaking and therefore not subject to federal authority. He reasoned that Central Western and CN were operated as separate undertakings rather than in common; further, CN was not dependent on the services of Central Western for its own operations. Nor was Central Western integrated in a functional sense within a so-called "Western Grain Transportation Network."[45]

Despite the Court's ruling in this particular case, Chief Justice Dickson's judgement illustrates the very broad reach of federal regulatory authority in this field. The functional character of the Court's approach is noteworthy. Even where there is in form two separate undertakings, the courts will inquire into the degree of practical or operational integration between the undertakings. Federal regulatory authority will extend to any operations that are regarded as essential or conducted in common with a core interprovincial undertaking. The practical effect of this approach is to ensure an expansive interpretation to federal authority under sections 92(10)(a) and (b) of the *Constitution Act, 1867*.

## WORKS DECLARED FOR THE GENERAL ADVANTAGE OF CANADA

Paragraph 92(10)(c) of the 1867 Act provides an exception to the principle that local works and undertakings are subject to exclusive provincial jurisdiction. This subsection provides that the Parliament of Canada may simply declare that a local work is "for the general advantage of Canada or for the advantage of two or more of the provinces"; such a declaration is sufficient to bring an otherwise local work within federal regulatory authority.

This power has been used close to 500 times, mostly in the late 19th and early 20th centuries and in most cases in relation to railways.[46] It can be used in relation to a specific work or to a broad class of works.[47] Moreover, the "works" in question need not be limited to the field of transportation or communication but can involve any sort of physical or tangible thing.[48] Once the declaration is issued, the courts will not inquire into whether the work is in fact for the general advantage of Canada. The declaration by Parliament will be regarded by the courts as dispositive.[49]

Various commentators have suggested that the declaratory power is inconsistent with classical principles of federalism since it permits the federal government to increase its jurisdiction unilaterally at the expense of the provinces.[50] The power has fallen into relative disuse and appears to have been used only twice in the last 25 years.[51] A recent federal proposal that the power be abolished[52] is discussed later in this study.

## PEACE, ORDER AND GOOD GOVERNMENT

The opening words of section 91 of the *Constitution Act, 1867* grant the Parliament of Canada power ". . . to make laws for the Peace, Order and good Government of Canada, in relation to all Matters not coming within the Classes of Subjects by this Act assigned exclusively to the Legislatures of the Provinces." While this source of federal authority has generally been interpreted narrowly by the courts, one important exception has been in the field of transportation. The "Peace, Order and good Government" power has been held to support exclusive federal jurisdiction over air transportation.[53] The Supreme Court of Canada found aeronautics to be a "distinct subject matter" which went beyond local concern and "must from its inherent nature be the concern of the Dominion as a whole."[54]

The effect of the *Johannesson* case was to include all aspects of aeronautics, including purely local aeronautics undertakings, as subject to exclusive federal authority. Thus the distinction between interprovincial and local undertakings, which has been critical in the judicial interpretation of section 92(10), has no application to the field of aeronautics. Even purely local airline operations fall under exclusive federal regulatory authority, without any requirement that the local operation be connected to or integrated with an interprovincial undertaking.[55]

Given the settled nature of federal jurisdiction over aeronautics, the litigation in this field has tended to focus on a variety of subsidiary issues such as the extent to which provincial laws of general application apply to airports. The courts have tended to hold that airports and aeronautics undertakings are exempt from the application of any provincial legislation which affects a vital part of the federal undertaking. For example, it has been determined that airports are exempt from municipal zoning bylaws of general application[56] as well as from height restrictions imposed by a province on land adjacent to an airport.[57]

A second issue that has produced some litigation is the extent to which federal jurisdiction extends to undertakings that are connected to aeronautics. Here, the courts have relied on the jurisprudence developed in relation to section 92(10)(a); the issue has been whether the related undertaking is sufficiently integrated with the main aeronautics undertaking. For example, in the *Field Aviation* case,[58] the Alberta Court of Appeal held that a company engaged in the servicing of aircraft was so intimately connected with aeronautics as to fall within federal jurisdiction. On the other hand, a company constructing airport runways,[59] as well as companies offering porter services or limousine service to and from the airport[60] have been held to be separate undertakings subject to provincial jurisdiction.

## OTHER CLASSES OF SUBJECTS

Three other enumerated classes of subjects assigned to Parliament in section 91 of the *Constitution Act, 1867* deal explicitly with matters related to the field of transportation.[61]

These are:

91.9 Beacons, Buoys, Lighthouses and Sable Island

91.10 Navigation and Shipping

91.13 Ferries between a Province and any British or Foreign Country or between Two Provinces.

Federal authority over transportation matters is also supplemented by section 108 of the *Constitution Act, 1867*, which provides as follows:

> 108. The Public Works and Property of each Province, enumerated in the Third Schedule to this Act, shall be the Property of Canada.

The Third Schedule includes the following classes of provincial public works and property:

1. Canals, with Lands and Water Power connected therewith.
2. Public Harbours.
3. Lighthouses and Piers, and Sable Island.
4. Steamboats, Dredges, and public Vessels.
5. Rivers and Lake Improvements.
6. Railways and Railway Stocks, Mortgages, and other debts due by Railway Companies.
7. Military Roads.

Although the Third Schedule transfers to the federal government all improvements or public works associated with rivers and waterways, the ownership of the rivers themselves remains with the provinces.[62] This means that the provinces may legislate with respect to the use of these waters, as long as their legislation does not interfere with federal legislation in relation to navigation and shipping.

The most important source of federal authority from the above catalogue of powers is section 91(10), "Navigation and Shipping". The language in the section is unqualified, suggesting that federal authority could be extended to all aspects of this subject. However, for many years the courts seemed to take the position that this head of power was circumscribed by the same limits that had been developed with respect to federal undertakings under section 92(10)(a).[63] In *Agence Maritime v. Canada Labour Relations Board,*[64] for example, it was held that local shipping was subject to provincial labour relations legislation. Similarly, ferries that operated largely within the waters of British Columbia were held to be within provincial jurisdiction for purposes of labour legislation.[65] In these cases, the courts seemed to interpret federal authority over navigation and shipping as extending primarily to interprovincial and international undertakings.

The most recent decision of the Supreme Court of Canada on this issue suggests a somewhat more expansive reading of federal authority over navigation and shipping. In *Whitbread v. Walley* (1990),[66] the issue was whether certain limitations of civil liability contained in the *Canada Shipping Act*, R.S.C. 1970, c.S-9 applied to a pleasure boat operated within provincial waters. The Supreme Court unanimously held that the provisions in the *Canada Shipping Act* applied uniformly to all shipping, including local shipping as well as pleasure boats. Mr. Justice La Forest, writing for the Court, distinguished the federal power over navigation and shipping in section 91(10) from that applicable to works and undertakings in section 92(10)(a). Whereas federal jurisdiction over works and undertakings was limited to interprovincial and international transportation, there was no such limitation with respect to navigation and shipping. La Forest J. stated that Parliament's jurisdiction over maritime law should be viewed as territorially co-extensive with its jurisdiction in respect of navigable waterways.[67] He rejected the idea that any distinction could be made between local shipping and interprovincial shipping. Instead, he took the view that all navigable waterways within Canada are part of a single navigational network which must be subject to a uniform legal regime. La Forest J. drew an analogy between navigation and shipping and the field of aeronautics which, as noted above, has been regarded as a single subject matter within the exclusive authority of Parliament. This is so, Justice La Forest suggested, because it is functionally impossible to make a distinction between air travel of a local versus an interprovincial nature. The same situation holds true, according to Justice La Forest, with respect to navigation and shipping. This points to the need for a uniform regulatory and legal regime for navigation and shipping and for "a broad reading of the relevant head of federal jurisdiction."[68]

The analogy which Mr. Justice La Forest draws between "navigation and shipping" and "aeronautics" is significant. Certainly the federal power over navigation and shipping has never been regarded as being as extensive as the power over aeronautics.[69] This result is somewhat ironic, given the fact that the area of navigation and shipping is an enumerated head of federal authority, while aeronautics has simply been added through judicial interpretation of the federal residual power. The result and the reasoning in *Whitbread and Walley* indicate the Supreme Court's willingness to reassess this situation and to consider expanding the limits of federal authority over navigation and shipping.

## REGULATORY FRAMEWORK

As to the manner in which governments have actually exercised their constitutional authority, our analysis thus far indicates that the courts have taken a much more expansive approach to federal authority over transportation matters than they have in other fields, such as federal authority to regulate trade and commerce.[70]

To what extent does the federal and provincial legislation enacted in this field reflect the fairly centralized scheme contemplated by the formal Constitution? In general terms, the regulatory framework does recognize a leading role for the federal government over transportation matters. However, in certain instances the federal government has chosen not to exercise the full range of authority which it has been allocated under the Constitution. Of course, this is a political rather than a constitutional stipulation, one which can be reversed by ordinary legislation.

What follows is a brief overview of the regulatory framework that has been put in place in the four principal modes of public passenger transportation: air, water, rail and motor vehicle. The focus of this analysis is on particular modes of transportation or forms of regulation which have been an important source of litigation or court decisions in the past. As such, there is no attempt to provide a comprehensive outline of federal or provincial legislation relating to transportation matters.[71] The main purpose of including this information is to provide a more complete understanding of how governments have actually used their formal powers set out in the Constitution.

### Air Transportation

The federal government currently dominates the regulation of all air passenger transportation in Canada. Under the *National Transportation Act, 1987* it has exclusive responsibility for regulating the provision of all air services in Canada; and under the *Aeronautics Act* it regulates the safety and security of passengers, aircraft, airport and aviation facilities. All air carriers in Canada are subject to exclusive federal regulation under these statutes, including carriers engaged in purely local transportation. The provincial role in the transportation field is currently limited to establishing and directly operating certain airports as well as subsidizing some air passenger services.[72] Almost all of the airports and airstrips owned and operated by provincial governments are located in remote, northern areas of the provinces.[73]

Three provinces directly subsidize air passenger services; one province (Ontario) has established a provincial Crown corporation to provide air passenger services directly in Northern Ontario.[74] However, all the provincially-operated airports as well as all air passenger services must be federally licensed and meet all the relevant federal regulatory requirements. In short, the regulatory framework governing aeronautics reflects the centralized interpretation developed by the Supreme Court of Canada in this area.

### Marine Transportation

The primary public mode of marine passenger transportation is provided by passenger and automobile ferries. The Parliament of Canada has established safety requirements under the *Canada Shipping Act* which apply to all ferry services, including ferries operating within a province. This statute represents a codification of the "rules of the road" for all navigation and shipping within Canadian navigable waters. The federal government also assumes responsibility for the provision of ferry services between provinces,[75] as well as for certain ferry services that are intra-provincial in nature.[76] Many of the provinces also provide local ferry services, the most important of these being provided by British Columbia, Ontario, Newfoundland and Quebec.[77] However, even these provincially operated services are subject to the safety and operational requirements of the *Canada Shipping Act*, thus ensuring a uniform regulatory framework across the country. The provinces have not imposed any additional ferry safety requirements on services which they operate or subsidize but would be free to do so as long as their regulations did not conflict with the paramount provisions in federal law.

### Rail Transportation

The federal Parliament regulates the vast majority of passenger rail services in Canada. The federal government has responsibility for all interprovincial and international railways, as well as for any other railways which have been declared to be for the general advantage of Canada. This includes the vast majority of all passenger rail operations in the country. These rail services are regulated by a variety of federal statutes including the *National Transportation Act, 1987* (NTA) and the *Railway Act* (RA). The NTA provides for an administrative agency, the National Transportation Agency, and grants it certain regulatory powers in relation to federally-regulated passenger rail services. Certain decisions of the Agency can be varied or rescinded by the federal Cabinet.

Provincial regulation of passenger rail services is extremely limited. In British Columbia,[78] Ontario[79] and Quebec[80] there are various provincially operated or subsidized local rail services which are subject to provincial regulation. But these provincial services are confined mainly to commuter rail networks or to remote, northern regions. The vast majority of all passenger rail activity is subject to exclusive federal regulation.

**Motor Vehicle Transportation**

The primary public mode of motor vehicle transportation is provided by the bus industry. As noted above, the Privy Council decision in the *Winner* (*supra* note 16) case established that bus undertakings engaged in regular interprovincial service fell under exclusive federal authority. However, the bus industry had traditionally been regulated at the provincial level, and the federal government had no regulatory structure in place to assume control over the industry. Accordingly, within months of the Privy Council decision in *Winner*, the federal government delegated the regulation of interprovincial undertakings back to the provinces.

The *Motor Vehicle Transport Act, 1987* transfers regulatory authority over interprovincial motor vehicle undertakings to provincially appointed boards. The provincial boards are granted the authority to license the undertakings and to determine the terms and conditions under which they will operate.

It is an established principle of Canadian constitutional law that one level of government cannot directly delegate legislative powers to another level of government.[81] Thus it was inevitable that questions would be raised regarding the validity of the delegation to provincial boards under the *Motor Vehicle Transport Act*. However, the Supreme Court of Canada upheld the validity of the delegation in *Coughlin v. Ontario Highway Transport Board*,[82] ruling that a provincial board, validly constituted under provincial law to regulate local undertakings, could be vested with the authority to regulate extra-provincial undertakings. This left the regulation of the bus industry to the provinces and has led to significant variations in the applicable regimes governing bus operations across the country.[83]

Two general points should be noted about the delegation of authority to regulate the bus industry. First, the delegation under the *Motor Vehicle Transport Act, 1987 (MVTA)* can be revoked, altered and limited by ordinary federal legislation. Indeed, there is already a provision in the MVTA permitting the federal Cabinet to exempt certain undertakings from the Act through regulation.[84] This exemption has only been used on one occasion, with respect to the Roadcruiser bus service in Newfoundland.[85] The point is that it can be used at any time in the future by the federal government without the necessity of obtaining provincial consent. This would mean that the federal government could resume responsibility for the regulation of any or all aspects of the interprovincial bus industry simply by passing an Order in Council or by amending the terms of the *Motor Vehicle Transport Act, 1987*.

The second general point is that there appear to be some limits to the capacity of the federal government to delegate authority to the provinces. In *Coughlin* the provincial board that was granted the authority was already validly established under provincial law. Implicit in this decision, therefore, is the requirement that the provincial legislation establishing the provincial board be valid independently of any federal law.[86] This would mean that the province could not establish a board or agency whose sole purpose was to regulate interprovincial undertakings.[87] The provincial legislation establishing such an agency would be beyond the constitutional capacity of the provinces, since there would be no valid provincial purpose which the agency was fulfilling.

## FUTURE LITIGATION

This discussion indicates that the main outlines of jurisdiction in the field of transportation are now relatively settled. Over the years, the courts have identified a series of general principles which govern the allocation of jurisdiction over transportation. These principles are reasonably well understood by both government and industry, and the dividing line between provincial and federal responsibility is relatively clear.

However, transportation issues will continue to be a frequent source of constitutional litigation in the future. This litigation will arise out of the attempt to apply the general principles identified by the courts to the facts of specific cases. While such issues will vary, one or two central issues will tend to recur with particular frequency.

The first of these issues is the extent to which federal regulation can be extended to local undertakings which have been integrated or connected with interprovincial undertakings. Future transportation systems will place an emphasis on developing more integrated forms of travel, permitting Canadians to use different modes of transportation on a single trip.[88] As local and interprovincial modes of transportation become more integrated, the constitutional jurisdiction over these systems might shift in favour of the federal government. As we have seen, the courts have adopted a functional approach to the issue of jurisdiction, inquiring into the degree to which there is common management or operation of various transportation undertakings. As intermodal transportation increases, the issue will be the extent to which an otherwise purely local transportation undertaking becomes integrated within some larger interprovincial network. In such cases, the precise dividing line between federal and provincial responsibility may be uncertain and require clarification by the courts.

A second, related issue which may produce future litigation relates to a possible move away from regulation based on distinct modes of transportation. In the past, governments have tended to establish separate schemes of regulation for specific modes of transportation. In recent years, however, there has been a recognition that certain issues, such as safety, security, substance use and environmental pollution cut across all modes.[89] The federal government has responded by enacting legislation based on a particular issue or public purpose rather than on a specific mode of transportation.[90] Within this context, the distinction between "local" and "interprovincial" undertakings is largely meaningless. For example, legislation designed to regulate environmental harm will presumably be aimed at all undertakings with possible adverse effects on the environment. Yet purely local undertakings may cause just as much harm to the environment as interprovincial ones. Thus for such legislation to be truly effective, some means must be found to ensure that all undertakings which produce adverse environmental effects are subject to a set of common standards.

Since constitutional jurisprudence developed by the courts has been premised on a traditional, modal theory of government regulation, the principles which apply to one mode of transportation are quite different from those which apply to others. If the distinctions between modes begin to break down, it may cause the courts to re-evaluate some of its previous jurisprudence. In particular, it may prompt the courts to try to create some room for the development of a set of uniform principles — issue-specific rather than mode-specific — which would apply across a series of transportation modes. The regulation of adverse environmental effects is a prime instance of where such a re-evaluation might take place.

Even were this to occur, it would be an incremental process which would take many years to develop. The main outlines of constitutional authority over transportation policy are now so well settled, there should not be any significant shift in the courts' approach to these matters in the foreseeable future. The litigation which does arise will be issue-specific and narrowly focussed, and will turn on how the generally accepted principles apply to the facts of specific cases. These fact-specific judicial decisions are unlikely to involve significant implications for transportation policy makers and planners.

## III. PROPOSALS FOR CONSTITUTIONAL CHANGE

The first section of this paper has provided a snapshot of the current constitutional arrangements governing the field of transportation. The question which now arises is whether these existing arrangements require modification or amendment.

It is important to keep in mind the distinction between purely statutory arrangements, subject to amendment through ordinary legislation, and the dictates of the Constitution. The focus here is on the degree to which the terms of the formal Constitution require modification. The related issue of whether government policy in the transportation field ought to be altered in some way is beyond the scope of this paper.

This section begins with an examination of the degree to which the terms of the Constitution may have limited governments or the private sector from responding effectively to transportation issues. It measures the practical impact and significance of the Constitution on both government and industry. A number of issues arise here. First, has the Constitution prevented governments from putting in place forms of regulation which would be better suited to the underlying transportation marketplace? In effect, has the Constitution forced governments to rely upon inefficient or ineffective forms of regulation? Secondly, has the Constitution had any negative impact on the way in which the transportation industry delivers services to the public? For example, has it acted as a barrier to the development of more efficient modes of transportation?

Then follows an examination of various proposals for constitutional change; this assessment focusses on recent proposals for constitutional amendment which have surfaced on the public policy agenda and suggests which, if any, ought to be included in any amendments to the Constitution.

## THE PRACTICAL IMPACT OF EXISTING CONSTITUTIONAL ARRANGEMENTS

The transportation industry in Canada has undergone a fundamental transformation since Canada's original constitutional arrangements were put in place nearly 125 years ago. Despite this transformation, the Constitution has not prevented governments from responding effectively to the changing circumstances because of the courts' flexible and functional interpretation of the division of powers in the field of transportation. As the transportation industry has evolved, the courts have in effect updated the Constitution. This has ensured that any gaps or ambiguities are resolved in a satisfactory fashion. It has also meant that constitutional jurisdiction has evolved to take account of changing needs and circumstances in the industry.

The most obvious example of this constitutional "updating" is in air transportation. The courts have allocated exclusive jurisdiction over air transportation to the federal government, thus ensuring the development of an effective national air transport system. But the courts have taken a similarly broad interpretation to federal authority over interprovincial works and undertakings and have found that even predominantly local undertakings are subject to federal regulatory authority if they are engaged in regular interprovincial activity. This preference for federal authority is important, since it permits the creation of a national "level playing field" to govern the transportation industry.

This is not to say, however, that either the federal or provincial governments have put in place a regulatory structure which actually creates this level playing field. The Interim Report of the Royal Commission on National Passenger Transportation makes the observation that the laws affecting passenger transportation are "fragmented" and suggests that passenger transportation companies "may not be competing against other modes on a level playing field."[91] However, this fragmentation is more a result of policy decisions by successive governments than by the dictates of the Constitution.

Certainly with respect to the main public modes of passenger transportation — air, bus, marine and rail — the federal government possesses very broad regulatory powers under the Constitution. But the Constitution is largely permissive; it creates room for federal regulatory authority but does not require that authority to be exercised in any particular manner. Thus the federal government has chosen in some instances to delegate at least some of its authority back to the provinces.[92] In other cases, federal statutes have been drafted in such a way so as not to take complete advantage of the potential federal authority available in a particular area. For example, the *Canadian Transportation Accident Investigation and Safety Board Act* establishes a federal board with authority to investigate and report upon accidents in certain specified modes of transportation.[93] The Act does not apply to accidents occurring on highways, where the vast majority of all transportation accidents occur. However, there is certainly no constitutional reason which would prevent the federal government from extending the Act to govern at least some aspects of highway transportation.

As noted above, the federal government has authority over interprovincial undertakings operating on highways. Furthermore, the Parliament of Canada has enacted legislation governing the safety of new cars and components sold in Canada.[94] In addition, the federal Parliament regulates the behaviour of individual drivers through a variety of provisions in the *Criminal Code* of Canada. These various sources of federal authority would provide an ample basis for extending the application of the federal safety legislation to at least some aspects of highway transportation. Thus the fact that the legislation is framed more narrowly is attributable to factors other than the absence of appropriate constitutional authority in the federal Parliament.

What of the extent to which the Constitution may have indirectly limited the development of more efficient modes of transportation? Again, there seems little basis for concluding that the Constitution has had such an impact. Consider the development of intermodal or integrated systems of transportation, in which passengers might rely on more than one means of travel to arrive at their destinations.[95] Such systems depend upon the construction of terminals that serve airplanes, trains, buses and taxis; they also depend upon the development of support services such as intermodal baggage handling, scheduling, reservation systems and ticketing. It might be thought that divided constitutional jurisdiction in the transportation field might make the development of such intermodal systems more difficult to achieve. For example, the fact that the provinces have jurisdiction over local undertakings, while the federal government has jurisdiction over interprovincial undertakings, might be seen as a factor limiting the development of integrated transportation networks.

In fact, however, there would appear to be little basis for supposing that the Constitution would prevent the emergence of more integrated transportation systems. As noted in the first section of this paper, the courts have framed constitutional jurisdiction over transportation undertakings in functional terms. Federal jurisdiction extends to a purely local undertaking only when it is integral to the successful operation of the related interprovincial undertaking or when the two are managed in common. In short, there is no hard and fast distinction between those undertakings that are subject to provincial jurisdiction and those subject to federal authority. The jurisdictional line depends upon the facts and circumstances of particular cases and turns on the degree of functional integration between the various elements of a transportation network.

The greater the degree of functional integration between different modes of transportation, the more likely it will be that the integrated system as a whole will fall under exclusive federal jurisdiction. This is because the integrated or intermodal system will necessarily involve at least some undertakings or modes of transportation that already fall under exclusive federal authority. As these federally regulated modes of transportation become integrated within some larger network of transportation undertakings, the larger system itself may well become subject to exclusive federal jurisdiction. For example, jurisdiction over intermodal stations for buses, trains, urban transit and airplanes appears to be vested in the federal Parliament[96] because all air travel as well as a significant amount of bus and train travel are already within exclusive federal jurisdiction. The operation of terminals to link these federally regulated modes of transportation with other modes would be an integral part of these federally regulated undertakings. As such, the federal Parliament would possess exclusive authority to regulate the operation of such terminals.

There are, of course, numerous obstacles to the emergence of intermodal transportation systems. The infrastructure to support such systems is extremely costly, while the successful operation of the system can be frustrated by congestion and delays in the urban transportation network.[97] But these are economic, social and political problems, rather than constitutional ones. An amendment to the Constitution would not make the emergence of intermodal systems significantly more likely or feasible.

Thus, in general terms, I would conclude that the Constitution has not posed a serious problem for either government or industry in the transportation field in the past. This being said, it should also be recognized that there are inevitably going to be certain difficulties associated with divided jurisdiction over transportation matters. The main difficulty has already been alluded to earlier: divided jurisdiction carries with it the possibility that different modes or systems of transportation will find themselves competing on an uneven playing field. If regulations set by one level of government are inconsistent with those set by another, it may produce a situation in which a particular mode of transportation receives a competitive advantage.[98] This is particularly the case since it is now becoming apparent that competition occurs across transportation modes rather than simply within a particular mode. Within this context, the actions of all three levels of government — municipal, provincial and federal — have impacts on transportation policies undertaken at each level. For example, the choice between air, bus, rail or private automobile for a particular intercity traveller will be affected by such factors as the nature of the road system, the degree of urban congestion or the development of good public transit. Yet these factors are subject to the control of different levels of government. Thus, even though a particular mode of transportation might be subject to the exclusive control of a single level of government — such as aeronautics — the competitive position of that industry will be affected by decisions taken by other levels of government.

Some degree of divided jurisdiction would appear to be inevitable, since it is simply not feasible for a single level of government to assume jurisdiction over all matters which have an impact on the transportation sector. If divided jurisdiction is a fact of constitutional life, there will always be the possibility that the actions of one level of government might frustrate or undermine the policies of another. This problem cannot be solved through a constitutional amendment, since any amendment would still leave a situation in which jurisdiction was divided between two (or perhaps three) orders of government. The only long-term solution to the problem is to achieve greater coordination and cooperation between the various levels of government.

## PROPOSALS FOR CONSTITUTIONAL CHANGE

Over the last year, a variety of proposals for comprehensive constitutional change have been advanced both by governments and non-governmental bodies. While jurisdiction over transportation has certainly not been a central feature of any of these proposals, some of the proposed changes would affect transportation policy.

### 1. The Group of 22[99]

The Report of the Group of 22 recommends that the declaratory power of the federal government in section 92(10)(c) of the *Constitution Act, 1867* be abolished (recommendation 4). The Report also recommends that interprovincial and international transportation be federal and intra-provincial be provincial (recommendation 19). Since there is no elaboration of the intent underlying this recommendation, it is not clear whether it contemplates any change to the existing division of powers over transportation. In one sense, the recommendation might be regarded as an affirmation of the *status quo*, since subsections 92(10)(a) and (b) of the *Constitution Act, 1867* provide for federal responsibility for interprovincial undertakings and provincial responsibility for local undertakings. However, it is possible that it contemplates some reallocation of jurisdiction over aeronautics or navigation and shipping, which are now wholly subject to federal authority.

The Report also recommends that the residual power of the federal Parliament be deleted from the Constitution, leaving the question of the allocation of undetermined powers to the political process and the courts. The courts would allocate powers "based on the roles of the two orders of government as reflected in the distribution of powers" (recommendation 3). The effect of this proposal on constitutional jurisdiction over transportation is altogether unclear. Presumably the existing jurisdiction of the federal government over aeronautics, which flows from the federal residual power, would be maintained; it is unclear what would occur with respect to new modes of transportation.

### 2. The Allaire Report[100]

The Constitutional Committee of the Quebec Liberal Party proposes a comprehensive revision of the division of powers. The Committee proposes that transportation be an area of shared jurisdiction between the federal and provincial government, with Quebec having authority over what is termed "regional" transportation, while the federal Parliament would have authority over "inter-regional" transportation (p. 39). There is no indication whether the proposed provincial responsibility over "regional" transportation would involve transportation beyond the borders of the province of Quebec or whether it would be confined purely to intra-provincial transportation. The Allaire Committee also proposes to grant all residual powers to the provinces. There is no indication whether this would affect existing court decisions which have granted jurisdiction to the federal Parliament on the basis of the residual power.

### 3. Federal Government Proposals

The federal government's proposals for constitutional amendment, entitled *Shaping Canada's Future Together*, contain a number of recommendations with potential impact on transportation. The federal government proposes to abolish the declaratory power with respect to local works in section 92(10)(c) of the *Constitution Act, 1867* (proposal 23). It also proposes to limit the scope of the federal government's residual power (proposal 22). The federal residual power would not be abolished, however; the proposals contemplate that the federal government would retain authority over matters of "national concern," which was the basis for the Supreme Court's decision that aeronautics was a matter of exclusive federal authority. All that is proposed to be transferred to the provinces is authority for "non-national matters not specifically assigned to the federal government under the Constitution or by virtue of court decisions."[101] Finally, the federal government identifies a number of areas of jurisdiction which are "candidates for streamlining." The intent of this proposal is to eliminate duplication and overlap of services by the various levels of government. The list of items to be discussed with the provinces includes transportation of dangerous goods, ferry services and small craft harbours.[102]

### 4. Assessment

Both the federal government and the Group of 22 propose to abolish the federal declaratory power in section 92(10)(c) of the *Constitution Act,* *1867*. However, there is no discussion in either document of the rationale underlying this recommendation. One can only assume that it is based on the assumption that a unilateral power of this type is inconsistent with the equality of the two levels of government. Some commentators, as well as provincial governments, have criticized the declaratory power on this basis, arguing that it grants the federal government the power to extend its own jurisdiction unilaterally and reduce the jurisdiction of the provinces.[103]

These criticisms must be balanced against a recognition of the important role which this power has played in the past. For example, shortly after World War II, the federal government used the declaratory power to establish federal jurisdiction over atomic energy.[104] The existence of the declaratory power was important in this context since it permitted swift and effective action on the part of the federal government — a necessary response because of the implications of atomic energy on national security. Speedy and effective national regulation was essential. It is arguable that the courts would have eventually recognized that atomic energy would fall under federal authority as a matter of "national concern."[105] But even so, there would have been a period of uncertainty during which the status of the federal legislation would have been unclear. The existence of the declaratory power provided a means of virtually eliminating this uncertainty and ensuring effective and timely federal intervention.

Some commentators have suggested that the declaratory power has fallen into disuse and that its abolition would have little practical effect.[106] In fact, while it has been used sparingly in recent years, it was relied on by the federal government as recently as 1987.[107] And it is impossible to predict the kinds of situations or problems which may emerge in the future. The existence of the declaratory power preserves flexibility in the constitutional framework, ensuring the ability of the federal government to respond effectively to changing circumstances.

Despite these considerations in favour of retaining the declaratory power, it would seem preferable to impose some kind of limitation on its use by the federal government. The existence of such a unilateral and unconstrained power is inconsistent with the fundamental equality of the two orders of government.

Furthermore, while the declaratory power has served an important and useful function in the past, it must be remembered that this was during a period in which the Privy Council had adopted a very narrow interpretation to other sources of federal authority. The federal trade and commerce power, for example, was interpreted by the Privy Council as applying mainly to interprovincial and international trade. In recent years, the Supreme Court of Canada has adopted a much more flexible and expansive approach to the interpretation of the federal trade and commerce power. Thus the need for a unilateral federal power to declare works for the general advantage of Canada has diminished considerably.

It would seem appropriate to limit the use of the declaratory power in order to protect provincial interests. For example, it might be provided that the federal government could only invoke the power after obtaining the consent of the province in which a particular "work" is situated,[108] or that the federal government must obtain the consent of some number of provinces before issuing a declaration.[109] These changes would protect provincial interests while preserving some limited scope for the use of the declaratory power.

Both the Group of 22 and the Allaire Committee propose to eliminate the federal residual power from the Constitution. The federal government, on the other hand, proposes merely to limit the power. The total abolition of the residual power of the federal government might have significant implications in the field of transportation. As noted above, the courts have used the residual power to recognize exclusive federal authority over aeronautics. As new modes or methods of transportation emerge, the courts might well rely on the residual power as a basis for federal authority. To abolish the residual power altogether would appear to represent an unwarranted limitation on the powers of the federal Parliament.

The federal government proposals suggest that the provinces should be granted authority over "non-national matters not specifically assigned to the federal government." However, the federal government proposes to maintain its authority to deal with "national matters or emergencies."[110] This is important, since federal authority over aeronautics is based on the fact that this is a matter of national concern.[111] Thus it would appear that the federal proposals on the residual power do not contemplate any changes in the current jurisdiction over aeronautics. More importantly, the federal government could also acquire jurisdiction over modes or methods of transportation which might arise in the future. Jurisdiction over these would turn on the question of whether the transportation matter raised a question of "national concern."

In short, there does not appear to be any significant difficulty with the current federal proposals in relation to the residual power. The only real area of concern is whether it will be possible to find language that is sufficiently precise to distinguish between matters of "national" versus "non-national" importance. The current proposals require the addition of constitutional language to the opening words of section 91 of the *Constitution Act, 1867* to grant some additional scope for provincial authority. If the language is ambiguous or imprecise, then there could be unintended or unanticipated consequences in terms of the division of powers. Since the federal proposals do not set out the terms of a formal constitutional amendment, it is impossible to state in advance whether this concern is real or merely theoretical.

The other proposals outlined above do not appear to contemplate any significant realignment of responsibilities in transportation. In general terms, they assume the continuation of federal responsibility for interprovincial and international transportation, with the provinces maintaining control over local transportation. However, the federal proposals for streamlining government appear to contemplate some form of delegation of responsibility to the provinces in areas such as ferries and small craft harbours.

In an evaluation of such delegation, it should be noted that the Constitution already permits some degree of delegation of powers between governments. While the courts have held that direct delegations of powers between legislatures are invalid, they have permitted delegations made to third parties, such as administrative tribunals. Thus the federal Parliament has been able to delegate authority to regulate interprovincial motor vehicle undertakings to provincially-appointed regulatory tribunals through ordinary federal legislation — the *Motor Vehicle Transport Act, 1987*.

The immediate question is whether this existing delegation power might be employed to transfer regulatory authority over other transportation matters to provincial authorities. For example, could regulatory authority over interprovincial ferry services be transferred to a provincially appointed tribunal through an ordinary federal statute similar to the *Motor Vehicle Transport Act, 1987*? Alternatively, could jurisdiction over an interprovincial rail undertaking, such as a high-speed train operating in Ontario and Quebec, be transferred to the provinces?

The answer to these questions would depend on the precise nature of the delegation which was contemplated. The delegation in the *Motor Vehicle Transport Act, 1987* involved a transfer of authority to provincial boards which were already validly constituted under provincial legislation. It would appear that the federal government could make a similar delegation involving ferries, railways or any other mode of transportation. The only necessity would be that the provincial boards which were to exercise the delegated power be validly constituted under provincial law. The province or provinces would have first to create tribunal(s) with authority to regulate intra-provincial and local undertakings. These provincial boards could then receive delegated power from the federal government to regulate interprovincial undertakings operating into or within the province concerned.

There are obviously important limitations and drawbacks associated with a delegation of this type. Specifically, any delegation would have to involve several different provincial boards located in different provinces. These separate provincial boards would only be able to regulate the operations of an interprovincial transportation undertaking within the borders of a particular province. To give a concrete example of how this would work, suppose the federal government wanted to delegate authority to regulate a high-speed train running between Windsor and Quebec City to the provinces of Ontario and Quebec. The federal government would delegate authority over the Ontario operations of the undertaking to an Ontario board, while the Quebec operations would be subject to the authority of a Quebec board. The high-speed rail operation would then be subject to the authority of two separate regulators, one established by Ontario, the other by Quebec.

There would seem to be no way to avoid such divided jurisdiction, at least under the terms of the existing Constitution. It does not appear to be possible for the federal government to delegate authority over the complete operations of an interprovincial undertaking to a single provincially appointed board since no single province could validly create a board with such a mandate. An individual province is permitted only to create a tribunal with authority to regulate transportation undertakings operating within that province. For the same reason, no combination of provinces, acting in concert, can create a single board with authority to regulate the complete operations of an interprovincial transportation undertaking. Thus any attempt by the federal government to delegate regulatory powers over a complete interprovincial undertaking to a single provincially appointed board would be unconstitutional. This would amount to an attempt by the federal government to enlarge the legislative powers of the provinces, a form of delegation which is not permitted under the current constitution.[112]

If this analysis is correct, any delegation of regulatory authority over interprovincial undertakings such as ferries or railways would inevitably create a situation of divided regulatory authority. The major drawbacks to any delegation of this type could only be avoided through an amendment of the Constitution to provide for direct delegations of legislative power between the two levels of government. Significantly, the current federal proposals contemplate an amendment precisely along these lines. The federal government proposes to insert provisions in the Constitution "to enable the delegation of legislative authority between the two levels of government with the mutual consent of the legislative bodies involved."[113] If such provisions were enacted, they would permit the federal government to delegate authority over the complete operations of an interprovincial undertaking to a single provincially appointed tribunal.

There is a long history of similar proposals to permit delegations of powers directly between governments. The Fulton-Favreau amendment proposal of 1964 would have inserted a power of interdelegation in the Constitution. More recently, the Macdonald Commission recommended a constitutional amendment to permit legislative as well as administrative delegation of powers.[114] A similar proposal was endorsed by the Beaudoin-Edwards Committee examining the constitutional amending formula.[115]

Proposals along these lines have certainly attracted some measure of criticism in the past.[116] On balance, however, a carefully framed interdelegation power would appear to represent a positive contribution to our existing constitutional framework.[117] Such a power would permit greater flexibility in the way in which governments respond to social problems. In transportation, for example, it would open the door to a greater range of regulatory responses involving both levels of government. In particular, it would allow the federal Parliament to allocate responsibility over transportation matters on a regional as opposed to a purely provincial basis. There might well be circumstances, such as a high-speed rail service in the Windsor-Quebec City corridor, where such a regional form of regulation is appropriate. A constitutional amendment permitting legislative delegation of powers between the two orders of government would make this form of regional, interprovincial responsibility for transportation matters a possibility.

Such delegation of powers might also make it possible to fashion more creative responses to the difficulties associated with divided jurisdiction over transportation matters. As noted in the previous section, actions and policies of one level of government often significantly affect the activities of other levels of government. Furthermore, competition within the transportation field occurs across transportation modes as well as within a particular mode. If governments could delegate jurisdiction directly, it might be possible to create new regulatory structures to respond to these challenges more effectively. For example, short air trips compete directly with trips by cars and trains. It might be desirable to grant a single level of government the authority to regulate all three modes of transportation for trips involving limited distances.[118] Permitting direct delegations of legislative powers would add greater flexibility in the responses that are available to government. It would ensure that government regulation can be more closely tailored to the realities of the transportation industry as it evolves.

## IV. CONCLUSION

This paper has reviewed the current allocation of jurisdiction over transportation matters and assessed proposals for constitutional change. These arrangements have worked fairly well in the past because of the pragmatic interpretation of the division of powers by the courts. In contrast to their approach to many other areas of the Constitution, the courts have tended to employ a functional analysis in construing constitutional responsibilities over transportation matters. They have rejected the idea of dividing jurisdiction over a single undertaking between two levels of government. They have also held that where two transportation undertakings are functionally integrated or operated in common, they should be subject to a single regulatory authority. The practical effect of this approach has been to expand federal authority in this field. Since jurisdiction over particular undertakings is to be undivided, federal authority has been recognized over undertakings that are involved only minimally in interprovincial transportation. Similarly, federal authority has also been recognized in relation to local transportation undertakings which are functionally connected or integrated with interprovincial undertakings.

Because of this expansive reading of federal power, the Constitution has made it possible for a single level of government to play a leading role in transportation policy. The federal government has been able to facilitate the creation of a truly national transportation network across the country. I conclude that there is no need for major constitutional changes in the existing jurisdiction over transportation matters in the Canadian Constitution. The only only significant change which I propose is an amendment to permit the direct delegation of legislative powers between governments. This proposal, advanced recently by the federal government, would provide for greater flexibility and more effective coordination of the respective roles of governments. It would permit governments to adjust their responsibilities on an incremental basis in response to changing trends and circumstances in the transportation industry. In this way, the Constitution would not block or impede the effort to adapt our transportation system to the needs of future generations of Canadians.

## ENDNOTES

1. The focus of this study is on the provisions which grant legislative authority in the field of transportation. A companion study in this volume by Patrick J. Monahan, entitled "Transportation Obligations and the Canadian Constitution," examines a number of constitutional provisions which impose a particular obligation to provide transportation services. The constitutional obligations of the federal government will not be considered in any detail in the present study.

2. Government of Canada, *Shaping Canada's Future Together: Proposals* (Ottawa: Supply and Services Canada, 1991).

3. See, for example, *A Quebec Free to Choose, Report of the Constitutional Committee of the Quebec Liberal Party* (Montreal, January 1991); *Some Practical Suggestions for Canada*, Report of the Group of 22 (Montreal, 1991).

4. See, for example, C. McNairn, "Transportation, Communication and the Constitution," 47 *Canadian Bar Review* 355 (1969); C. McNairn, "Aeronautics and the Constitution," 49 *Canadian Bar Review* 411 (1971); C. Dalfen and L. Dunbar, "Transportation and Communications: The Constitution and the Canadian Economic Union," in *Case Studies in the Division of Powers*, ed. M. Krasnick, (Royal Commission on the Economic Union, Background Studies, Vol. 62, 1985), pp. 139–202.

5. For example, the extent to which the development of so-called "intermodal" forms of transportation might be constrained or limited by the Constitution is examined. Intermodal transportation involves the integration of different modes of transportation within a single network or system. The integrated system would connect modes either through a single reservation system or through common facilities, such as train stations, airports and bus terminals. See *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, April 1991), p. 141. It is important to emphasize that this aspect of the study focusses on constraints which are implicit in the scheme of the Constitution itself, as opposed to government regulation or legislation. An examination of the efficacy or limitations of existing government policy in the transportation field is beyond the scope of the present study.

6. See *A Quebec Free to Choose.*

7. See *Some Practical Suggestions for Canada.*

8. See *Shaping Canada's Future Together: Proposals.*

9. The issue here is the extent to which regulatory authority can be transferred from one level of government to another without the need to resort to a formal constitutional amendment.

10. See Peter Hogg, "Transportation and Communication," in *Constitutional Law of Canada,* 2nd ed., (Toronto: Carswell, 1985), p. 484.

11. Section 92(10)(a), *Constitution Act, 1867,* U.K., 30, 31 Victoria, c. 3.

12. See the Third Schedule to the *Constitution Act, 1867,* which sets out the classes of provincial property which passed to the Dominion at the time of Confederation. The transfer of title to the Dominion was effective at the moment of each province's entry into Confederation; as transportation was in a stage of infancy at the relevant dates, Dominion proprietary rights acquired in this way have not proven to be significant factors in the regulation of transportation. See McNairn, "Transportation, Communication and the Constitution," p. 366.

13. It should be noted, however, that the trade and commerce power has been used to regulate the safety of new cars and components. The *Motor Vehicle Safety Act,* R.S.C. 1985, c. M-10 requires all motor vehicles imported into Canada to comply with federal safety and environmental regulations. In addition, vehicles manufactured in Canada must have a National Safety Mark indicating that they meet the relevant federal safety and environmental standards.

14. See the *Criminal Code* of Canada, R.S.C. 1985, c.C-46, sections 249–261.

15. *Re Regulation and Control of Radio Communication in Canada* [1932] A.C. 304, p. 315.

16. See *A.G. Ontario v. Winner* [1954] A.C. 541.

17. See *Toronto v. Bell Telephone* [1905] A.C. 52.

18. *A.G. B.C. v. A.G. Can. (Natural Products Marketing Reference)* [1937] A.C. 377.

19. It should be noted that in recent years, the Supreme Court of Canada has moved away from this bifurcated approach to the trade and commerce power, recognizing federal authority to regulate general trade and commerce. See *General Motors of Canada Ltd. v. City National Leasing* (1989), 58 D.L.R. (4th) 255 (S.C.C.).

20. Of course, while this constitutional capacity has been vested in the federal government, it has not necessarily chosen to exercise the jurisdiction to its limits. See, for example, the *Motor Vehicle Transport Act,* 1987, R.S.C. 1985, c. 29 (3rd Supp.) s.4 (delegating authority to regulate extra-provincial bus undertakings to the provinces).

21. *Alberta Government Telephones v. Canadian Radio-television and Telecommunications Commission and CNCP Telecommunications* [1989] 2 S.C.R. 225, p. 257 (per Dickson, C. J.).

22. *Re Tank Truck Transportation Ltd.* (1960), 25 D.L.R. (2d) 161, Ont. High Court.

23. This result was affirmed by the Court of Appeal without written reasons. See [1963] 1 O.R. 272 (C.A.).

24. *R. v. Cooksville Magistrate's Court, Ex parte Liquid Cargo Lines Ltd.* [1965] 1 O.R. 84.

25. *AGT v. CRTC* [1989] 2 S.C.R. 225.

26. All the members of the Court agreed on the issue of jurisdiction; Madame Justice Wilson dissented on the issue of whether AGT was entitled to assert a claim of Crown immunity.

27. Ibid., p. 259.

28. Ibid., p. 257.

29. Ibid., p. 258.

30. Ibid., p. 262.

31. See P. Hogg, "Comments," (1990) 35 *McGill L. J.*, p. 480.

32. *Re Cannet Freight Cartage* [1976] 1 F.C. 174 (C.A.) (approved by the Supreme Court of Canada in *UTU v. Central Western Railway* [1990] 3 S.C.R. 1112, 1145–47.)

33. See Hogg, "Comment," p. 487.

34. Federal authority over Bell Canada and B.C. Tel was based on provisions in their respective Special Acts declaring them to be works "for the general advantage of Canada"; telephone service in Yukon, NWT and Newfoundland is provided by subsidiaries of CN Railway, which is subject to federal authority by virtue of provisions in the *Canadian National Railways Act.*

35. For a summary and discussion of the regulatory situation prior to the *AGT* case, see Dalfen and Dunbar, pp. 156–160.

36. Because the Supreme Court also held that AGT was entitled to benefit from the doctrine of Crown immunity, the result of the case was that the telephone company was subject neither to federal nor to provincial authority. The other two prairie telephone companies in Saskatchewan and Manitoba were in a similar situation. However, the four Atlantic telephone companies are privately owned and can claim no Crown immunity; the effect of the Court's decision was to immediately bring the four Atlantic companies within federal authority. In October of 1989 the federal government introduced Bill C-41, an amendment to the *Railway Act* to make the Act binding on the three prairie telephone companies. However, this bill died on the order paper and has not been reintroduced (as of October 25, 1991). At the moment, therefore, there is no federal legislation which is applicable to the three prairie telephone companies.

37. See *Montreal v. Montreal Street Railway* [1912] A.C. 333.

38. *Luscar Collieries Limited v. McDonald* [1927] A.C. 925.

39. *Reference re Industrial Relations and Disputes Investigation Act* [1955] S.C.R. 529.

40. *Letter Carriers' Union of Canada v. Can. Union of Postal Workers* [1975] 1 S.C.R. 178.

41. *UTU v. Central Western Railway* [1990] 3 S.C.R. 1112; (1990) 76 D.L.R. (4th) 1.

42. Dickson C.J., spoke for eight members of the Court on the constitutional issue; Madame Justice Wilson was the sole dissenter.

43. *UTU v. CWR*, 76 D.L.R. (4th), pp. 15–16.

44. Ibid., pp. 19-21.

45. It was argued that there was an integrated network for the transportation of grain within Western Canada and that Central Western formed part of this network. However, Dickson C. J. concluded that "I do not agree that a Western Grain Transportation Network exists for the purposes of the jurisdictional designation of the Central Western. . . . [T]he fact that several entities involved in the transport of grain fall under federal jurisdiction cannot on its own serve to bring everything connected with that industry under federal jurisdiction." Ibid., p. 22.

46. See Hogg, "Transportation and Communication," p. 491.

47. See *Jorgensen v. A.G.Can.* [1971] S.C.R. 725.

48. Ibid.

49. See N. Finkelstein, *Laskin's Canadian Constitutional Law*, 5th ed. (Toronto: Carswell, 1986), pp. 627–631.

50. See A. Lajoie, *Le pouvoir déclaratoire du Parlement* (Montreal: University of Montreal, 1969) pp. 70–72.

51. See *Cape Breton Development Corporation Act*, S.C. 1967, c.6, s.35(1); *Teleglobe Canada Reorganization and Divestiture Act*, S.C. 1987, c.12, s.9.

52. See *Shaping Canada's Future Together: Proposals*, proposal no. 23.

53. See *Johannesson v. West St. Paul* [1952] 1 S.C.R. 292.

54. Ibid., p. 308–09.

55. See *Jorgenson v. North Vancouver Magistrates* (1959) 28 W.W.R. 265 (B.C.C.A.).

56. See *Re Orangeville Airport Ltd.* (1976) 11 O.R. (2d) 546 (C.A.).

57. See *Re Walker and Minister of Housing for Ontario* (1983) 41 O.R. (2d) 9 (C.A.).

58. See *Field Aviation Company Limited v. Alberta Board of Industrial Relations* [1974] 6 W.W.R. 596 (Alta. A.D.).

59. See *Construction Montcalm Inc. v. The Minimum Wage Commission* [1979] 1 S.C.R. 754.

60. See *Re Colonial Coach Lines Ltd.* [1967] 2 O.R. 25 (Ontario H.C.); *Murray Hill Limousine Service v. Batson* [1965] B.R. 778 (Que. C.A.).

61. In addition to the three classes of subject noted in the text, the power over "trade and commerce" (section 91.2) and the power over "criminal law" (section 91.27) have been used to enact legislation that relates to transportation policy. See discussion *supra* at notes 13 and 14.

62. See *Attorney General of Canada v. Attorney General of Ontario, Quebec and Nova Scotia,* [1898] A.C. 700.

63. This, for example, was the view expressed by Dalfen and Dunbar in their study for the Macdonald Commission in 1985; see Dalfen and Dunbar, p. 150.

64. *Agence Maritime Inc. v. Canada Labour Relations Board,* [1969] S.C.R. 851.

65. *Singbeil v. Hansen* (1985) 19 D.L.R. (4th) 48 (B.C.C.A.).

66. *Whitbread v. Walley* (1990) 120 N.R. 109.

67. Ibid., p. 120.

68. Ibid., p. 123.

69. For example, labour relations matters in all aeronautics undertakings are subject to exclusive federal authority; in the field of navigation and shipping, federal authority has been limited to undertakings engaged in interprovincial and international activity.

70. See discussion *supra* at note 18 and accompanying text.

71. For example, the regulatory framework with respect to the road system or to private passenger automobiles is not included in this discussion. Neither of these areas has been the source of any significant litigation or court decisions.

72. For an extended discussion of the provincial role in this regard see IBI Group, "Intercity Passenger Transportation Policy Framework: Provincial Economic and Safety Legislation Review" a working paper prepared for the Royal Commission on National Passenger Transportation, October 1990, pp. 3–7.

73. Ibid., p.4. Overall provincial involvement in operating and subsidizing airports has been increasing in the past decade: in 1979, the provinces operated or subsidized about 124 land airports, whereas in 1989 this number had grown to 378. However, Transport Canada continues to operate the largest and busiest airports in Canada and its annual airport related expenditures are about 11 times higher than those of the provinces combined.

74. The province of Ontario has established norOntair to provide subsidized air services to 21 communities in Northern Ontario. In 1988, the operating subsidy for norOntair was $4.3 million.

75. Certain of these ferry services are a constitutional obligation of the federal government, including ferries in Prince Edward Island, Newfoundland and British Columbia. These obligations are contained in the respective Terms of Union admitting these provinces to Canada. Each of the obligations are thus part of the Constitution of Canada and take precedence over all federal and provincial legislation. Further, they may only be amended in accordance with the procedures set down in Part V of the *Constitution Act, 1982*. For a discussion of the precise nature and implications of these various obligations, see Monahan, "Transportation Obligations and the Canadian Constitution."

76. The federal government has, in recent years, sought to devolve responsibility for the provision of intra-provincial ferry services to the provinces. The usual arrangement has the province agreeing to assume responsibility for a service in exchange for payment of a fixed sum from the federal government. For a discussion, see IBI Group, "Intercity

Passenger Transportation Policy Framework: Federal Legislation Review," a working paper prepared for the Royal Commission on National Passenger Transportation, June 1990, pp. 14–16.

77. For example, British Columbia has established a Crown corporation (British Columbia Ferry Corporation) to provide ferry services in the province. Tolls and service schedules are established by the Corporation's board of directors and must be approved by the provincial Cabinet. The Corporation also receives a substantial subsidy from the provincial government.

    In Newfoundland, the province directly operates seven intra-provincial coastal ferry services, while an eighth service is subsidized. These services were taken over from the federal government in 1979. Service schedules and fares are developed by the Newfoundland Department of Transportation.

    The Quebec Ministry of Transportation operates or subsidizes about a dozen longer-distance ferry routes across the St. Lawrence River and along the North Shore of the Gulf of St. Lawrence.

    For further descriptions of these various provincially operated or subsidized services, see IBI Group, "Intercity Passenger Transportation Policy Framework: Provincial Economic and Safety Legislation Review," pp. 14–19.

78. The British Columbia Railway provides passenger service between North Vancouver and Prince George, B.C.

79. The Ontario Northland Railway offers passenger rail service in Northern Ontario, while GO Transit provides mainly commuter rail services, some of them on its own trackage, in the Greater Toronto Area. Ontario has also established the Ontario Northland Transportation Commission and granted it the authority to operate and regulate rail services in Northern Ontario. Decisions of the Commission are subject to amendment by the provincial Cabinet.

80. The Montreal Urban Community Transport Commission offers commuter rail services in the Montreal area.

81. This principle was established by the Supreme Court of Canada in *A.G. Nova Scotia v. A.G. Canada* [1951] S.C.R. 31.

82. *Coughlin v. Ontario Highway Transport Board* (1968), 68 D.L.R. (2d) 384.

83. For a discussion of these provincial variations, see IBI Group, "Intercity Passenger Transportation Policy Framework: Provincial Economic and Safety Legislation Review," pp. 20–33.

84. See section 16 of the MVTA, 1987 which provides as follows:

    > The Governor in Council may, by regulation, on the recommendation of the Minister made after consultation by the Minister with the government of each province affected thereby, exempt from the application of this Act or of any provision of this Act, either generally or for a limited period or in respect of a limited area, any person, the whole or any part of any extra-provincial bus undertaking or extra-provincial truck undertaking, every extra-provincial

bus undertaking or extra-provincial truck undertaking, any group or class of such undertakings or any extra-provincial bus transport or extra-provincial truck transport.

85. The Roadcruiser bus service, operated by CN in Newfoundland, was initiated in 1968 when CN shut down the passenger rail service in Newfoundland and substituted a bus service in its place. It was exempted from the MVTA in the mid-1970s following a dispute between CN and the Board of Commissioners of Public Utilities of Newfoundland.

86. This is the view expressed by Peter Hogg in his discussion of the *Coughlin* case. See Hogg, *Constitutional Law of Canada*, 2nd ed., p. 303.

87. This limitation will prove to be significant in our discussion later in this paper.

88. See *Getting There*, pp. 141–42.

89. Ibid., p. 40.

90. See, for example, the *Canadian Transportation Accident Investigation and Safety Board Act*, S.C. 1989, c.3.

91. See *Getting There*, p. 44.

92. See the provisions of the *Motor Vehicle Transport Act, 1987* noted in the previous section, delegating authority over the bus industry to the provinces.

93. *Canadian Transportation Accident Investigation and Safety Board Act*, S.C. 1989, c.3. See section 3 for a definition of the application of the Act.

94. See the *Motor Vehicle Safety Act*, R.S.C. 1985, c.M-10.

95. See discussion in *Getting There*, pp. 103–05.

96. The possibility of establishing some sort of Canadian Terminals Agency is discussed in *Getting There*, p. 149.

97. For a discussion of these various factors, see *Getting There*, pp. 104–05.

98. Ibid., p. 226.

99. See *Some Practical Suggestions for Canada*.

100. *A Quebec Free To Choose*.

101. *Shaping Canada's Future Together*, p. 58.

102. Ibid., see pp. 58-59.

103. See Hogg, *Constitutional Law of Canada*, p. 493.

104. See *Atomic Energy Control Act*, S.C. 1946, c.37.

105. This was the reasoning of the Ontario High Court in *Pronto Uranium Mines Limited v. The Ontario Labour Relations Board*, [1956] O.R. 862.

106. Hogg (*Constitutional Law of Canada*, p. 493) suggests that the declaratory power has not been used since 1961.

107. See the *Teleglobe Canada Reorganization and Divestiture Act*, S.C. 1987, c.12, s.9.

108. See, for example, the *Cape Breton Development Corporation Act*, S.C. 1967, c.6, which recites that the provincial government had consented to the legislation containing a federal declaration under section 92(10)(c) of the *Constitution Act, 1867*.

109. These suggestions have been made before and are reviewed and discussed in Hogg, *Constitutional Law of Canada*, p. 493.

110. See *Shaping Canada's Future Together*, Proposal 22.

111. This was the basis of the reasoning by the Supreme Court of Canada in the *Johannesson* case, *supra* note 53.

112. This is the basic proposition established by the *Nova Scotia Interdelegation Case*. For a discussion of the principles established by this case, and an analysis which leads to similar conclusions proposed in the text, see Hogg, *Constitutional Law of Canada*, pp. 307–08.

113. See *Shaping Canada's Future Together*, Proposal 25.

114. See The Macdonald Commission, *Report of the Royal Commission on the Economic Union and Development Prospects for Canada*, Vol. III, p. 257.

115. See Special Joint Committee of the Senate and the House of Commons, *The Process for Amending the Constitution of Canada*, June 20, 1991, p. 29.

116. Critics of legislative interdelegation argue that it would promote uncertainty and would "confuse the basic political responsibility and accountability of members of the federal Parliament and the federal Cabinet, and too much of this could destroy these federal institutions." See W. R. Lederman, "Some Forms and Limitations of Co-operative Federalism," 45 *Canadian Bar Review* 409 (1967), p. 426.

117. The interdelegation power would have to be framed so as to ensure that a delegation might be revoked upon the giving of proper notice. The delegation would also have to be framed in relatively precise terms and in accordance with certain principles or criteria agreed upon in advance by both levels of government.

118. This is suggested in *Getting There*, p. 227.

## 10

# TRANSPORTATION OBLIGATIONS AND THE CANADIAN CONSTITUTION

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October 1991

## I. INTRODUCTION: TRANSPORTATION AND THE CANADIAN CONSTITUTION

> The problems and methods of transportation constitute an essential thread in the development of the country.[1]

Transportation policy has always occupied a critical and central place in Canadian nation-building. The close connection between transportation policy and national policy is nowhere more evident than in the terms of the Canadian Constitution itself. Canada is unique among the developed nations of the world for the number and detail of transportation obligations which have been entrenched in its formal constitution.

The *British North America Act, 1867* (now called the *Constitution Act, 1867*) recites the undertaking of the Canadian government to secure the construction of a railway linking the former colonies with each other; British Columbia entered the Union in 1871 in return for a constitutionally entrenched guarantee of a transcontinental railway; the *Prince Edward Island Terms of Union* require the Canadian government to maintain a ferry service linking the Island with the mainland; the Newfoundland Terms of Union (*Newfoundland Act*) provide a guarantee of ferry service between the new province and the

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Canadian mainland. These are merely illustrations of a considerable list of similar constitutional provisions guaranteeing particular transportation services or infrastructure.

Students of Canadian history have long remarked on the number and specificity of these constitutional obligations.[2] The most significant of these relate to undertakings to construct or to take over railways in various parts of the country.[3] It seems that the Canadian government fulfilled these obligations to the ultimate satisfaction of all concerned in the latter half of the 19th century; thus, while of considerable historical interest, such obligations have not been seen as playing a significant role in shaping modern transportation policy in Canada.[4]

More recently, however, interest in the status and meaning of these constitutional obligations has been revived because of the termination or reduction of passenger rail service in many parts of the country. Two provinces have argued that certain proposed reductions are unconstitutional on the basis that they violate constitutional guarantees given to these provinces when they joined Confederation. While Prince Edward Island's legal challenge failed,[5] the challenge in British Columbia succeeded in the trial division of the British Columbia Supreme Court, with the Court ordering the reinstatement of passenger service on a rail line on Vancouver Island.[6] This ruling has recently been upheld by the British Columbia Court of Appeal.[7] The success of this challenge has raised the issue of whether this and other transportation obligations in the Canadian Constitution might indeed have a role to play in the future evolution of Canadian transportation policy.

This paper presents a comprehensive analysis of the legal status, meaning and significance of transportation obligations in the Canadian Constitution.[8] It describes and analyzes the current legal status of the obligations to determine the extent to which they will influence, constrain or shape future transportation policy. While the focus of the paper is on the contemporary legal significance of the obligations, much of the analysis is historical because the current significance of the obligations can only be understood through a review of the purpose and meaning of the obligations when they were first enacted. The report details the circumstances surrounding the enactment of these various obligations as well as the then-prevailing understanding of their meaning and purpose. It also considers the manner in which the obligations have been carried out over the years and the extent to which the original understanding of their meaning has been reflected in subsequent government policy or judicial decision. Finally, it assesses the current significance of the obligations and whether they should be considered by transportation policy makers concerned with meeting Canada's transportation needs into the next century.

The Canadian practice of specifying certain transportation obligations in its fundamental constitutional law has often been regarded as somewhat out of the ordinary. The larger question, however, is whether there is any reason in principle to object to the practice. The concluding section of this paper reflects on the wisdom of the Canadian approach to constitution making. Alternative methods are suggested which would stop short of formal constitutional entrenchment of an obligation to provide named transportation services.

## II. THE CONFEDERATION ERA 1867–1873: TRANSPORTATION UNDERTAKINGS AS THE INSTRUMENT OF POLITICAL UNION

### A. *BRITISH NORTH AMERICA ACT, 1867*

A variety of factors led to the union of the British North American provinces in the mid-1860s, including the fear of annexation by the United States as well as the termination of the reciprocity treaty by the Americans in 1865.[9] But the key factor in securing support for the scheme, at least among the Maritime colonial leadership, was the commitment to construct an intercolonial railway. As one commentator has put it: "[c]ertainly there could have been in 1867 no confederation without the Intercolonial: there might have been an Intercolonial without confederation."[10]

By the early 1860s, the idea of constructing an intercolonial railway linking the Maritime provinces with Canada had been under discussion for at least two decades. Negotiations to build a rail link had been pursued actively but the discussions had ultimately foundered when the Canadians were unwilling to accept certain conditions demanded by Great Britain. By 1862, negotiations reached a stalemate.

When delegates from the various colonies of British North America gathered at Charlottetown in 1864 to discuss political union, the representatives from

New Brunswick and Nova Scotia saw the meeting as an opportunity to pursue their goal of securing a rail link with the markets of Canada. The Maritime delegates insisted that the construction of an intercolonial railway was a non-negotiable condition of their support for political union with Canada.[11] Nor were the Maritimers willing to accept a mere political commitment from the Canadians that such a railway would be constructed following Confederation. Instead, they insisted that the guarantee should be written into the terms of the imperial statute creating the new federation. Invoking the authority of Westminster would provide an ironclad guarantee that the Canadians would keep their promise to build the railway.

At the time there did not appear to have been any great controversy or objection to this way of explicitly guaranteeing the construction of the Intercolonial. Subsequent commentators have suggested that it is somewhat out of the ordinary to make explicit reference to the construction of a railway in a country's constitution. It should be remembered, however, that what was being contemplated was the enactment of an ordinary British statute. It is perfectly commonplace for ordinary legislation to make reference to quite specific matters, including the carrying out of contractual obligations. Clearly, the colonial leaders of British North America in the 1860s approached the matter on this footing. They were seeking to ensure that the commitment to build the Intercolonial could not be reversed by a subsequent Canadian government. The easiest and most straightforward way to secure this commitment was to set it out explicitly in an imperial statute. The British authorities would act as the "guardians" of the commitment, since any change in the terms of the undertaking would require the consent of Westminster.

The draft resolutions agreed to at the Quebec Conference in the fall of 1864 committed the new Canadian government to building the Intercolonial. Resolution 68 from the Quebec Conference reads as follows:

> 68. The General Government shall secure without delay the completion of the Intercolonial Railway from Rivière-du-Loup through New Brunswick to Truro in Nova Scotia.[12]

The importance attached to the construction of the Intercolonial is evident in a comparison of resolution 68 with the terms of resolution 69 from the Quebec Conference. Resolution 69, in its reference to the construction of a railway linking the western territory and the Pacific Ocean with the proposed federation, offered the following commitment:

> 69. The communications with the Northwestern Territory and the improvements required for the development of the trade of the Great West with the Seaboard, are regarded by this Conference as subjects of the highest importance to the Federated Provinces, and shall be prosecuted at the earliest possible period that the state of the finances will permit.[13]

The delegates clearly thought that cost considerations would govern the timing of the construction of the rail link with the west. The commitment to construct the western railway, while regarded as a subject of the "highest importance," was left to the discretion of the new government of the Dominion "at the earliest possible period that the state of Finances will permit." There was no such concern for cost with respect to the Intercolonial. The construction of that railway was expressed in mandatory terms: the general government "shall" secure the completion of the Intercolonial "without delay." The commitment was unqualified and unavoidable. The Canadian government was to secure construction of the railway without regard to considerations of cost or feasibility. The resolutions left no doubt that the construction of the Intercolonial was, from the point of view of the Maritimes, a "condition precedent" for political union.

The London resolutions in 1866 carried forward the explicit and unqualified commitment to construct the Intercolonial. Resolution 65 provided as follows:

> 65. The construction of the Intercolonial Railway being essential to the consolidation of the Union of British North America, and to the assent of the Maritime Provinces thereto, it is agreed that provision be made for its immediate construction by the General Government, and that the Imperial guarantee for three millions of pounds sterling pledged for this work be applied thereto, so soon as the necessary authority has been obtained from the Imperial Parliament.

The London version differed in certain important respects from the terms set out in the Quebec resolutions of 1864. First, the proposed railway was simply described as the "Intercolonial," without any reference to the starting or endpoint of the line; the reference to Rivière-du-Loup and to

Truro had been dropped. Second, while the London version referred to the fact that the construction of the Intercolonial was "essential to the consolidation" of the British Colonies, the language expressing the commitment was surprisingly vague. Whereas the Quebec resolution had indicated in mandatory terms that the General Government "shall secure, without delay, the completion of the Intercolonial Railway," the London version simply referred to the fact that "provision be made for its immediate construction by the General Government."

Finally, the London version stated that the Imperial Government would guarantee a loan of three million pounds sterling to enable the construction to proceed. The addition of this guarantee was of great practical value and represented the most significant modification from the earlier Quebec resolutions. Constitutional commitments are hardly worth the paper they are written on if they are not backed by the necessary funds. The financial guarantee from Great Britain would ensure that the constitutional commitment to build the Intercolonial would become a practical reality.

The wording of the London resolutions served as the basis for the drafting of the *British North America Act* (BNA Act) in January and February of 1867.[14] Section 145 of the *British North America Act, 1867*, as enacted by the British Parliament, set out the formal commitment to build the Intercolonial in the following terms:

> 145. Inasmuch as the Provinces of Canada, Nova Scotia, and New Brunswick have joined in a Declaration that the Construction of the Intercolonial Railway is essential to the Consolidation of the Union of British North America, and to the Assent thereto of Nova Scotia and New Brunswick, and have consequently agreed that Provision should be made for its immediate Construction by the Government of Canada: Therefore, in order to give effect to that Agreement, it shall be the Duty of the Government and Parliament of Canada to provide for the Commencement, within Six Months after the Union, of a Railway connecting the River St. Lawrence with the City of Halifax in Nova Scotia, and for the Construction thereof without Intermission, and the Completion thereof with all practicable Speed.

It can be seen that the first half of section 145 tracks precisely the terms of the comparable London resolution. It recites the agreement that the construction of the Intercolonial was essential to the union and that "provision should be made for its immediate Construction." The second half of the section, however, is new, setting out a "Duty" of the Government and Parliament of Canada. Certain features of the duty should be emphasized:

1. Whereas previous versions had referred only to the obligation of government alone, section 145 established a duty of the Government and *Parliament* of Canada. This is significant, since the duty to build the railway was thereby entrenched as a limitation on the legislative authority of the Canadian Parliament itself.
2. The obligation had a specific time frame attached; the construction was to commence within six months and was to proceed "without Intermission and . . . With all practicable Speed." Significantly, however, there was no specific date set for completion of the railway.[15]
3. The Intercolonial is specifically identified as linking the "River St. Lawrence with the City of Halifax," similar to the wording of the original Quebec resolution in 1864.
4. Section 145 makes no reference to the financial guarantee of the imperial government. This was because the financial guarantee was secured by a second imperial statute passed contemporaneously, entitled *An Act for authorizing a Guarantee of Interest on a Loan to be raised by Canada towards the Construction of a Railway connecting Quebec and Halifax.* Under this bill, three million pounds were provided for the construction of the railway.[16]

While the Parliament and Government of Canada undertook to secure the construction of the railway, section 145 is silent as to:

- the route to be selected for the railway;
- the amount to be spent on its construction; and
- the manner in which the railway would be operated once it has been completed, including such matters as fares and the general level and quality of service on the road.

However, these matters were dealt with elsewhere in the Act. Sections 92(10)(a) and 91(29) of the BNA Act granted the federal Parliament exclusive legislative authority over interprovincial railways. Thus the Parliament of Canada, as opposed to the legislatures of the provinces, was granted exclusive legislative authority over the Intercolonial Railway. While Parliament's legislative authority was fettered to the extent that it was obliged to construct the railway, upon completion Parliament would be free to regulate the actual operation of the railway in accordance with the policy of the government of the day.

The larger significance of section 145 was in the precedent it established. Having secured the consent of New Brunswick and Nova Scotia to Confederation with the promise of a railway, the Canadian authorities would soon find that similar promises would be demanded from other prospective provinces. The Canadians would also find that the price would rise with the passage of time; the undertakings which Canada was asked to take on would become more costly and the terms and conditions more difficult to fulfil. Still, having once agreed to such a request, the Canadians could find little reason to reject subsequent proposals. The only issue to be negotiated was the extent and nature of the transportation obligations to be shouldered by the new federal government.

## B. WESTERN EXPANSION: THE *MANITOBA ACT, 1870* AND THE *BRITISH COLUMBIA TERMS OF UNION* (1871)

The *British North America Act, 1867* made specific provision for the eventual expansion of the country westward to the Pacific Ocean.[17] In 1870 and 1871, the new nation began to make good on this promise of an expanded union as the provinces of Manitoba and British Columbia entered Confederation. But the terms on which the two provinces joined Canada were quite different, at least in the transportation obligations which were constitutionally assumed by the Canadian government.

For Manitoba, there were no specific constitutional entitlements to transportation services or infrastructure included in the *Manitoba Act, 1870*. In fact, the Act stated that any provision setting out a particular obligation regarding another province or group of provinces had no application with respect to Manitoba.[18] This meant, for example, that the guarantee of a transcontinental railway made to British Columbia was made to that province alone and had no application to Manitoba. The explanation for this variation in approaches is straightforward. Manitoba, unlike British Columbia, did not have to be persuaded to join Confederation. The huge land mass to the west of Ontario known as Rupert's Land and the North-Western Territory was annexed to Canada by imperial Order in Council in 1870.[19] Immediately following the admission of the territories, the federal Parliament by statute created the province of Manitoba out of part of Rupert's Land. Since the land in question was already included within the Dominion, there was no need to use transportation promises to induce the new province to join Confederation.

Such was not the case with British Columbia. In 1867, the colony of British Columbia had watched the creation of the Canadian federation with great interest, even to the extent of passing a resolution in favour of admission to the Dominion. Following the annexation of Rupert's Land in 1870, delegates were sent from British Columbia to Ottawa to discuss the terms of B.C.'s entry to the federation.

British Columbia's interest in union with Canada did not prevent the western delegates from seeking advantageous terms for joining. Before leaving Victoria, the Legislative Council had debated and approved a series of specific proposed terms for admission to Canada, including specific undertakings for transportation services or infrastructure which were to be guaranteed by the Dominion. As in the case of the Intercolonial Railway, these were to be explicitly set out in the Terms of Union and thus permanently bind the Government of Canada. The most significant of these proposed guarantees was for a transportation link between British Columbia and the rest of the Dominion. British Columbia sought two commitments from Canada in this regard:

1. Construction of a coach road between B.C. and Fort Garry, to be completed within three years;
2. The immediate commencement of surveys for a transcontinental railway, with Canada committed to completion of the railway "at the earliest practicable date"; construction of the B.C. portion of the railway was to commence within three years.[20]

Note that, while the Dominion was asked to actually construct the coach road and to open it for traffic within three years, no firm time frame was even requested with respect to the construction of a railway. The B.C. proposal simply asked that the railway be constructed "at the earliest practicable date"; what was "practicable" would no doubt be influenced by considerations of cost and feasibility. At the time, no surveys had been made of the route through the mountains of British Columbia. Thus the overall cost of the undertaking was unknown and probably unknowable in advance.[21] In short, the opening proposal from the British Columbians clearly contemplated that it might be quite some time before the transcontinental railway was actually completed.

What is somewhat surprising is that the final terms agreed upon went beyond the colony's request. Term 11 of the B.C. Terms of Union provided as follows:

> 11. The Government of the Dominion undertake to secure the commencement simultaneously, within two years from the date of the Union, of the construction of a railway from the Pacific towards the Rocky Mountains, and from such point as may be selected, east of the Rocky Mountains, towards the Pacific to connect the seaboard of British Columbia with the railway system of Canada; and further, to secure the completion of such railway within ten years from the date of the Union.
>
> And the Government of British Columbia agrees to convey to the Dominion Government, in trust, to be appropriated in such manner as the Dominion Government may deem advisable in furtherance of the construction of the said railway, a similar extent of public lands along the line of railway throughout its entire length in British Columbia, not to exceed, however, twenty (20) miles on each side of said line, as may be appropriated for the same purpose by the Dominion Government from the public lands in the north-west territories and the Province of Manitoba. Provided that the quantity of land which may be held under pre-emption right or by Crown grant within the limits of the tract of land in British Columbia to be so conveyed to the Dominion Government shall be made good to the Dominion from contiguous public lands; and provided further, that until commencement, within two years, as aforesaid, from the date of union, of the construction of the said railway, the Government of British Columbia shall not sell or alienate any further portions of the public lands of British Columbia in any other way than under right of pre-emption, requiring actual residence of the pre-emptor on the land claimed by him. In consideration of the land to be so conveyed in aid of the construction of the said railway,

> the Dominion Government agree to pay to British Columbia from the date of the Union, the sum of 100,000 dollars per annum, in half-yearly payments in advance.

The final version of the Terms of Union made no reference to British Columbia's original request for construction of a coach road linking the colony with Canada. However, the Government of the Dominion had assumed a much more onerous obligation regarding the construction of a transcontinental railway. The nature of the obligation can be discerned by comparing the main features of Term 11 with the original British Columbian request:

1. Term 11 stated that construction on the railway linking B.C. with the rail system of Canada had to begin *within two years* of the date of union and that construction had to start simultaneously in British Columbia and in Canada; under the original B.C. proposal, the only requirement was that construction of the initial sections of the railway *in B.C.* was to begin *within three years;*
2. Term 11 stated that the railway had to be completed *within 10 years* of the union; the original B.C. proposal merely required the construction to be completed at "the earliest practicable date."

It is unclear why the Canadians were prepared to accept such an onerous obligation, particularly the requirement that the railway be completed within 10 years. Early drafts of section 145 of the BNA Act had contemplated the establishment of a fixed completion date for the Intercolonial, but the Canadians resisted the idea that the BNA Act should specify a date for completion. In the B.C. case, the Canadians were prepared not only to fix a completion date for the railway but were prepared to do so for a project immeasurably more difficult than the Intercolonial.[22]

The main explanation for this new approach appears to relate to the Canadian government's desire to bind its successors to its own railway policy.[23] Certainly the inclusion of the fixed completion date for the project aroused considerable opposition when it was debated in the Canadian Parliament. The leader of the Liberal opposition, Alexander Mackenzie, moved an amendment to the Terms of Union to the effect that Canada should be pledged only to make surveys and to build the railway as finances might allow. But Mackenzie's amendment was defeated, and the unqualified obligation to complete the railway within 10 years was approved.

It should be noted that the formal constitutional obligation of Canada was limited to the actual construction of the railway; there is no mention of operation of the railway. Once the construction was completed, Canada would have fulfilled its obligation under Term 11. The absence of any requirement to "maintain" the railway after its completion was not accidental. In formulating its original request, the B.C. Legislative Council had instructed its negotiators to seek a commitment that Canada would construct "and maintain" a coach road linking the colony with Canada.[24] Similarly, B.C. had requested that an "efficient Coast Mail Service . . . be established and maintained. . . ."[25] Thus the omission of reference to any requirement to "maintain" the railway suggests that the obligation was simply to construct the railway and not to operate or maintain it afterward.

There were other transportation obligations assumed by the federal government under the B.C. Terms of Union. Under Term 4, the Dominion undertook to "provide an efficient mail service, fortnightly, by steam communication between Victoria and San Francisco, and twice a week between Victoria and Olympia; the vessels to be adapted for the conveyance of freight and passengers." This obligation was in response to what had originally been two separate requests from the B.C. delegation: (a) that the Dominion government "supply an efficient and regular fortnightly steam communication between Victoria and San Francisco" and (b) that the Dominion government "establish and maintain" efficient coast mail service between Victoria, New Westminster, Nanaimo "and such other places as may require such services."[26] Steam communication between Victoria and San Francisco was requested because San Francisco was the western terminus for the American transcontinental railway, at the time, and the main means of communication between British Columbia and Canada. Ferry service to San Francisco then, was an important transportation link with the other Canadian provinces. At the same time, it was recognized that the San Francisco ferry service would become unnecessary once the Canadian transcontinental railway was completed.

During the debate over the Terms of Union in the B.C. Legislative Council, it was argued that the reference to a ferry service to San Francisco was a mere "makeweight," and not an essential condition of the colony's entry into Confederation.[27] In the end, the British Columbian proposals requested that a ferry service to San Francisco be "supplied"; the comparable B.C. proposal dealing with the coastal mail service stated that such service was to be "established and maintained." The absence of any requirement to "maintain" the San Francisco service might be taken to suggest that the obligation would not necessarily continue indefinitely.[28]

Term 4 of the B.C. Terms of Union combines these two requests. Under Term 4, the Dominion is required to "provide" an efficient mail service linking Victoria with both San Francisco and Olympia on the mainland. The absence of the explicit requirement to "maintain" the service may indicate some ambiguity as to the duration of the commitment. There is no indication as to the precise meaning which the drafters associated with the requirement to "supply" mail service. Unlike Term 11 and the transcontinental railway however, Term 4 of the B.C. Terms of Union suggests that the obligation to supply ferry services in British Columbia was an obligation that would continue over time. Nor is there any indication that the obligation to "supply" the service would terminate at some fixed point in time. It seems that the Dominion requirement to "supply" the named ferry service was expected to continue indefinitely, until such time as the Terms of Union themselves were amended.[29]

## C. THE *PRINCE EDWARD ISLAND TERMS OF UNION* (1873)

While Prince Edward Island delegates had participated in both the Charlottetown and Quebec conferences in 1864, the Islanders were opposed to the proposed terms of Confederation as reflected in the Quebec resolutions. One of the main complaints was that the Quebec resolutions required construction of the Intercolonial; the P.E.I. delegates regarded the Intercolonial as imposing a heavy tax burden on Island residents without any corresponding benefit.[30] Following the Quebec Conference, the Prince Edward Island colonial Legislature passed resolutions rejecting the proposed terms of Confederation.

Following Confederation, negotiations to secure the Island's admission to Canada continued. In December of 1869, the Canadian government made a formal offer of new terms that were a significant improvement over what had been offered to P.E.I. under the Quebec resolutions. One of the terms in the Canadian offer was for provision of a ferry service linking the Island with the mainland. The Canadian offer stated that "Efficient Steam Service for the conveyance of mails and passengers was to be established and maintained between the Island and the Mainland of the Dominion, Winter and Summer, thus placing the Island in continuous communication with the International Railway and the Railway system of the Dominion."[31] Although the 1869 offer had been framed in accordance with the advice of R.P. Haythorne, the Premier of the Island, it was still regarded as inadequate by the Island government.

One of the main objections was that the new terms made no provision for construction of a railway on the Island. At a series of public meetings held in Prince Edward Island in early 1870, it was argued that the terms would be acceptable only if they were supplemented by a sum sufficient for the construction of a railway. It was suggested that since P.E.I. would have to bear a portion of the expense of building Canadian railways, it was appropriate for the other provinces to contribute towards the construction of a railway on the Island.[32] In April of 1870, the P.E.I. Legislative Council unanimously rejected the proposed Canadian terms.

In 1871, the Island decided to undertake construction of a railway on its own, without assistance from Canada. Legislation was passed providing for the construction of a railway the length of the Island, with the contractors to be paid through the issuance of debentures. The P.E.I. government estimated that the annual interest on the required capital would amount to 30,000 pounds, money that could be raised through a combination of modest tax increases and revenues raised from the operation of the road.[33] The actual costs, however, wildly exceeded these estimates. By 1873, total expenditures on the Island railway had exceeded $3.2 million and the annual interest on the debt was nearly $200,000. To place this debt load in perspective, the entire Island revenue from all sources for 1873 was a mere $395,000.[34] The Island was simply unable to meet the financial obligations associated with the railway and looked to Confederation with Canada as a means of escaping bankruptcy.

Negotiations with the Canadian and imperial authorities began in early 1873. While the Canadians realized that the Island's financial crisis had prompted the negotiations, they agreed to relatively generous terms to secure the admission of P.E.I. to Confederation. The final Terms of Union were drafted and mutually signed on May 15, 1873. The Dominion was to take over the railway that had threatened to cause the financial collapse of the Island government.[35] While the cost of the railway was to be charged against the Island as a local debt, the Dominion agreed to a "debt allowance" of $50 per capita, twice the amount which had been agreed to in the case of the other provinces. P.E.I. was to receive an interest payment from Canada on the difference between its "debt allowance" and its actual debts upon admission.[36] Furthermore, since Canada had taken over the Island railway, all further costs associated with the railway would be the responsibility of the Dominion government rather than the Island.

It was further agreed that the Dominion government would "establish and maintain" a ferry service linking the Island with the mainland.[37] The use of the word "maintain" is significant; this was the first occasion that the Canadian government accepted the responsibility to ensure the continued operation of a transportation service. The undertaking was apparently open-ended, and there is specific reference to the fact that the ferry service must place the Island in "continuous communication" with the mainland. However, the use of the word "maintain" in connection with the ferry service coupled with its absence in the case of the Island railway is significant. It indicates that the obligation to "take over" the railway does not entail any obligation to "maintain" or actually operate the system.[38]

One final transportation obligation of a relatively minor nature was included in the P.E.I. Terms of Union. The Dominion government assumed the cost, approximately $2,500 per year,[39] of maintaining telegraph communication between the Island and the mainland.[40] As with the ferry service, the obligation to "maintain" the telegraph entailed an ongoing obligation until such time as the Terms of Union themselves were modified.[41]

## III. MAKING GOOD ON THE OBLIGATIONS, 1873–1945: TRANSPORTATION UNDERTAKINGS AS AN INSTRUMENT OF NATIONAL POLICY

Transportation undertakings played a key role in securing political support for Confederation among the colonial leadership in British North America. The distinctive feature of these undertakings was their explicit guarantee by imperial statute. Successive Canadian governments would be bound, as a matter of law, to carry out the undertakings agreed to at the time of Confederation. The "guarantee" by Great Britain insulated them from the vagaries of Canadian party politics and from the unpredictable hazards of electoral contests. This was their overwhelming attraction to reluctant or doubtful political leaders in the various colonies.

It was one thing to assume certain obligations and have these obligations set out in imperial legislation. It was quite another matter actually to carry them out. The Intercolonial or the transcontinental railway may have existed on paper but passengers or freight could not be moved by means of constitutional language alone, no matter how majestic or unambiguous the wording. Moreover, the transportation undertakings which the Canadian government had assumed in the 1867–1873 period were extremely onerous, given the significant debt load which the new federation had inherited from the former colonies. There was no reason to assume that the government of the new Dominion would be capable of meeting all such obligations.

## A. THE INTERCOLONIAL RAILWAY

In late 1867, the Parliament of Canada passed *An Act respecting the construction of the Intercolonial Railway.*[42] This Act authorized the construction of the Intercolonial from Rivière-du-Loup to Halifax and placed the project under the authority of a board of four commissioners appointed by the Government (section 3). The Act also provided for a loan of four million pounds to finance construction, of which three million was guaranteed by the imperial government (sections 27, 32). The Chief Engineer, Sir Sandford Fleming, estimated the total cost of the project to be approximately $20 million.

The legislation did not specify the route which the Intercolonial should follow. This was a matter of considerable controversy, particularly with respect to the location of the line through New Brunswick. Some argued that the line should run close to the American border in order to take advantage of railways which had already been constructed; others argued for a northern route which would be safer from a military point of view; still others suggested a central line through the province.

In the end, political and military considerations won out and the northern route was followed, a decision that proved to be a source of resentment and grievance for Maritimers for many years. Maritime political leaders charged that the northern route added to the cost of construction while increasing the distance and the costs of transportation between Halifax and the markets of Central Canada. The decision in favour of the northern route, as well as the subsequent government management of the railway, contributed significantly to the sense of Maritimers' regional grievances over their status within the federation.[43]

The railway was completed in 1876. The final cost of construction came to $34 million, some $14 million more than estimated, with the difference being financed entirely by the Government of Canada.[44] Control of the railway had been removed from the four commissioners and placed directly under the authority of the federal Minister of Public Works in 1874.[45] The Government of Canada found itself in the business of running a railroad.

From the day it opened, the Intercolonial was a losing proposition. In part, this was a product of the artificially low rates which were charged on the line. On average, freight rates on the Intercolonial were discounted approximately 20 percent from comparable rates in Central Canada. The Maritimes insisted that these discounted freight rates were appropriate, because of the selection of the longer northern route through New Brunswick. In 1927, this preferential rate structure for the Maritimes was given a statutory basis in the *Maritime Freight Rates Act, 1927* (S.C. 1927, c.44) whose purpose was described as to give "certain statutory advantages" in rates to persons and industries in "select territory" (section 7).

It must be emphasized that the decision to grant preferential rates was a matter of government policy rather than constitutional entitlement; nothing in section 145 of the BNA Act constrained the Government of Canada in its determination of rates on the Intercolonial. The lack of connection between section 145 and the rate structure is illustrated by the repeal of section 145 by the United Kingdom Parliament in 1893. Despite this repeal, the Maritimes insisted on continuation of the policy of discounted rates and the successive Canadian governments carried on with this preferential policy.

The Intercolonial never became profitable. In 1923, along with other government-owned railways (the P.E.I. Railway, the Grand Trunk and Grand Trunk Pacific and Canadian Northern), it was amalgamated into the Canadian National railway system.[46] Since then, what had been the Intercolonial has continued to be operated as a public enterprise by either CN or VIA Rail.

## B. BUILDING THE CANADIAN PACIFIC RAILWAY

In 1871, the Canadian government decided that the railway to the Pacific would be built by a private corporation rather than by the government itself (see S.C. 1871, c.71). The government would provide assistance to the contractors through grants of land and subsidies, up to a limit of 50 million acres and $30 million. But the negotiations between the government and potential contractors soon became mired in scandals and charges of corruption, eventually bringing down the Macdonald Government in 1873.[47]

The subsequent Mackenzie administration had an entirely different attitude towards the construction of the Pacific railway, believing that the line could be built only as financial resources permitted. Prime Minister Mackenzie took the view that the promise of completion within 10 years was physically impossible to fulfil and should never have been given in the first place. Negotiations began between British Columbia and Ottawa in an effort to find some compromise acceptable to all parties.

The federal government sought an extension of the time for completion, and in return offered to construct a railway on Vancouver Island between Esquimalt and Nanaimo. The British Columbia government was unhappy with this proposal, maintaining that the construction of the Esquimalt-Nanaimo line was part of the original obligation under Term 11.[48] The negotiations dragged on for years with the Colonial Secretary, Lord Carnarvon, acting as an arbitrator and trying to help the parties identify a mutually acceptable compromise.[49]

The two governments finally reached agreement in 1883, two years *after* the original deadline for construction of the CPR. By this time, the main line of the railway was nearing completion. The Settlement Agreement of 1883 stated that it represented a settlement of all claims by the province in respect of "delays in the commencement and construction of the Canadian Pacific Railway and in respect of the non-construction of the Esquimalt and Nanaimo Railway." As for the island railway line,[50] British Columbia was to transfer a large portion of land on Vancouver Island to Canada which in turn agreed to grant this land to a private company for the construction of the line. The land would be exempt from taxation by the province as long as it was used for railway purposes. The federal government agreed to provide a subsidy of $750,000 for the construction of the Island railway. Under the terms of the Agreement, construction was to "commence forthwith" and was to be completed by June of 1887.[51]

The Agreement was ratified by legislation passed by the B.C. Legislature and by the Parliament of Canada,[52] and the federal government contracted with a private company to construct the line. The terms of this second agreement were attached as a "schedule" to the federal legislation implementing the Settlement Agreement with British Columbia. Under this agreement, the contractors (known as the Dunsmuir Syndicate) were obliged to "construct, complete, equip, maintain and work continuously" the line of railway between Esquimalt and Nanaimo (section 3 of the Agreement). The contractors also agreed to maintain the railway "in good and efficient working and running order" (section 9) and to equip the railway in accordance with specifications set down by the federal government (section 10). The construction proceeded largely according to schedule, and in 1886 the 70-mile stretch of railway between Esquimalt and Nanaimo was completed and opened for traffic.

While the governments were reaching a settlement of these issues, the construction of the CPR main line was nearing completion. Under the terms of a contract signed in 1881, the federal government granted the Canadian Pacific Railway Company a subsidy of $25 million and a land grant of 25 million acres to complete the railway by May of 1891. The company was also granted a permanent exemption from taxation by all levels of government.[53] In return, the company agreed to construct the line and to "thereafter and forever efficiently maintain, work and run the Canadian Pacific Railway."[54] The terms of the contract with the CPR were approved and ratified by federal legislation.[55] In November of 1885, Donald Smith hammered in the last spike of the Canadian Pacific Railway and the project of a transcontinental railway was finally completed.

All the various agreements, contracts and statutes entered into regarding the completion of the Canadian Pacific Railway were incorporated into federal or provincial legislation and, accordingly, were legally binding. However, these statutes have been a source of considerable litigation over the years, primarily in relation to attempts by provinces to modify or cut down the tax exemptions which they contemplated.[56] But the important point, from a constitutional standpoint, is that none of these agreements or statutes altered section 11 of the B.C. Terms of Union. Thus, while they may have been legally enforceable, they were not constitutionally entrenched. They could be amended or modified by Parliament or by a province, subject to the paramountcy of federal laws over provincial laws.[57]

For example, in 1950 the Privy Council decided that the British Columbia legislation granting a tax exemption for railway lands on Vancouver Island could be amended or repealed by the provincial legislature.[58] Similarly, the federal legislation establishing the Canadian Pacific Railway was ordinary federal law which could be amended or repealed as the Parliament of Canada saw fit.[59] In this sense, the agreements did not themselves constitute a constitutional limitation on the jurisdiction of Parliament. The only constitutionally mandated obligation remained that specified in Term 11 of the B.C. Terms of Union: to secure the construction of the CPR.

While fulfilment of Term 11 proved a source of great controversy and dispute, there were no significant problems in satisfying the other transportation obligations in the B.C. Terms of Union. To fulfil its obligation to provide efficient mail service between Victoria and both San Francisco and Olympia, the federal government contracted with private carriers and paid any necessary subsidies. There is no record of any complaint from the province regarding the quality or level of the service. In 1925, the two governments agreed that further subsidy of the Victoria to San Francisco service was unnecessary. The federal subsidy of $3,000 which had been paid towards this service was used by the province to improve mail service within British Columbia rather than for the San Francisco service.[60]

While the province had agreed that the federal government should be "relieved of its obligation to maintain a subsidized steamship service between Victoria and San Francisco,"[61] no change was made in the Terms of Union themselves. Accordingly, Term 4 of the Terms of Union continues to refer to the obligation to provide mail service on the Victoria–San Francisco route, even though this service was discontinued in 1925.

## C. THE PRINCE EDWARD ISLAND FERRY

In the years following Confederation, the operation of the ferry service connecting P.E.I. with the Canadian mainland proved to be a source of considerable dispute. The federal government was obliged to provide this ferry service under the Terms of Union with the province. The federal government attempted to fulfil this obligation by contracting with private companies to provide a subsidized service during the summer months. There appears to have been considerable dissatisfaction with the winter service which was provided by the government itself, using ferries operated by the Department of Marine and Fisheries.

In April of 1901, the province presented a memorial to the federal government alleging a failure by the Government of Canada to fulfil its obligation to provide a "continuous communication" between the Island and the mainland. The memorial claimed that the federal government's "solemn undertaking was systematically and continuously broken from the year 1873 to 1888 when for the first time in that latter year an adequate vessel was constructed and placed in service during the winter season."[62] The province claimed damages in the amount of $5 million for the alleged breach of the Terms of Union and asked that the claim be referred to a board of arbitrators. The federal government referred the claim to a committee which found that the federal government had failed to satisfy its obligations during the winter months of 1873 to 1887. The committee recommended that the province be paid an allowance of $30,000 annually as compensation. The government accepted the recommendation and passed legislation authorizing the payments, stating that they would "be paid and accepted in full settlement of all claims of the said province against the Dominion of Canada on account of the alleged non-fulfilment of the terms of Union."[63]

Following the 1901 settlement, there were further provincial complaints regarding the ferry service. In 1912, the Province presented another memorial seeking an increase in the annual subsidy set out in the 1901 legislation. The provincial claims were again referred to a committee for consideration. Following a series of negotiations, Parliament passed legislation authorizing an increase of $20,000.[64] The federal government has continued to pay these subsidies annually in accordance with the terms of the legislation.

Following these two settlements, provincial complaints regarding the operation of the ferry service appear to have diminished. The federal government contra[illegible] with Northumberland Ferries Limited to operate a ferry service betw[illegible].E.I. and Nova Scotia and, beginning in 1923, employed CN Railway to operate the service between P.E.I. and New Brunswick. Until the nation-wide strike by CN Rail in 1973, which resulted in a work stoppage of 10 days and a shutdown of the ferry service to New Brunswick, the federal government appears to have satisfied its obligations under the Terms of Union.

## D. SUMMARY: POLITICAL OVER LEGAL ENFORCEMENT

The various transportation obligations reviewed here were all established by imperial statute or Order in Council. As such, they were legally binding obligations that could not be unilaterally altered by the federal government. While the obligations were binding, the striking feature of these provisions is that there was no legal mechanism for enforcing them. The only machinery contemplated by the *British North America Act* for settling disputes between Canada and the provinces in 1867 was section 142, relating to disputes over the division of debts and assets — a mechanism that did not apply to transportation obligations. In the absence of legal machinery for settling disputes, the parties would have to rely on negotiation, political pressure or the intervention of third parties to ensure that the obligations were carried out.

The early history of these obligations confirms that this was in fact the prevailing understanding of how they were to be enforced. In each instance when a dispute arose, the parties commenced political negotiations designed to reach a compromise acceptable to both sides. There was no attempt to invoke judicial involvement in the settlement of the dispute. Thus the dispute between British Columbia and Canada over the construction of the CPR was resolved through direct political negotiations as well as through the intervention of the imperial authorities. Similarly, when the Prince Edward Island government became unhappy with the manner in which the Island ferry service was being operated, it presented a brief to the federal government rather than to the courts.

A second observation is that, because the enforcement mechanism was political rather than legal, the political authorities of the time resolved their disputes without regard to the precise legal limits of the particular obligation. Under the B.C. Terms of Union, for example, the federal government was obliged to construct a railway to the "Seaboard" of British Columbia; it later agreed to finance construction of a railway line on Vancouver Island, even though such a line was not expressly required.

Similarly, the only constitutional obligation of the British Columbia government under Term 11 was to transfer land that was directly along the main line of railway in the province; it later agreed to transfer an additional block of some 3.5 million acres in the interior of the province when the land originally to be transferred proved to be of lower value than expected.

The same pattern is repeated in the case of the Intercolonial Railway and the P.E.I. Terms of Union. In the case of the Intercolonial, the constitutional obligation of the Canadian government was limited to the actual construction of the railway. Subsequently, however, the government adopted a policy of discounting freight rates on the line, even though there was no constitutional obligation to do so. In P.E.I.'s case, the federal government agreed to provide an annual subsidy of $50,000 in perpetuity following provincial complaints over the quality of the ferry service.

In each case, there was no attempt to insist on the strict letter of the law; the overriding concern was to ensure that political compromises acceptable to all parties were achieved. Such reliance upon political mechanisms as an instrument of enforcing constitutional obligations was regarded at the time as entirely appropriate and straightforward. The political leaders of the 19th century would no doubt have been surprised by the modern tendency to rely on legal mechanisms to insist on strict adherence to constitutional commitments.

## IV. COMPLETING CONFEDERATION 1949: TRANSPORTATION UNDERTAKINGS IN THE NEWFOUNDLAND TERMS OF UNION

The Newfoundland Terms of Union contain the most detailed set of constitutional obligations of any province in Canada. This is hardly surprising since the drafters of the terms had before them the precedents established by the Terms of Union with the other provinces as well as the interpretation of those terms.

The colony of Newfoundland at the time of Confederation in 1949 was particularly concerned about the status of the Newfoundland Railway which it had started to build in the late 19th century. The cost of its construction imposed a crippling financial burden on the island economy, and the operation of the railway generated large financial losses.[65] Although the railway was taken over by the Newfoundland government in 1923, it remained unprofitable.[66] In the negotiations over the Terms of Union, the Newfoundlanders proposed that the federal government be responsible for any and all financial losses associated with the operation of the railway. The Canadian authorities' agreement is reflected in Term 31 of the Terms of Union:

> 31. At the date of Union, or as soon thereafter as practicable, Canada will take over the following services and will as from the date of Union relieve the Province of Newfoundland of the public costs incurred in respect of each service taken over, namely,
> (a) the Newfoundland Railway, including steamship and other marine services;

During the negotiations, the Newfoundland authorities expressed some concern that the Terms of Union did not require the federal government to continue operating the Newfoundland Railway. The only obligation stated in Term 31 was to "take over" the railway and to pay for any losses which might arise from its operation. This suggests that the federal government would be in compliance with Term 31 as long as it ensured that the province did not have to assume any of the losses of the Newfoundland Railway. But the federal government apparently reserved the right to determine the level of service on the railway or, indeed, to shut it down entirely.

During the negotiations leading to Newfoundland's entry into Confederation, the Newfoundland authorities sought clarification of what was entailed by Canada "taking over" the Newfoundland Railway. Prime Minister St. Laurent replied:

> During the course of our negotiations covering the final terms and arrangements for the union of Newfoundland with Canada a number of questions concerning Government policy were raised by your delegation and answered by the Canadian Government. In addition a number of temporary administrative arrangements were settled in order to facilitate the union.
>
> It would not seem fitting to include in formal terms of union matters of this kind, since they are scarcely of a constitutional nature. I am therefore sending you the enclosed memorandum covering these

various items. While these will not form part of the Terms of Union, they contain statements of the policy and intentions of this Government if union is made effective by the approval of the Parliament of Canada and the Government of Newfoundland and confirmed by the Parliament of the United Kingdom.

Yours sincerely
Louis S. St. Laurent
[enclosure]

STATEMENTS ON QUESTIONS RAISED BY THE NEWFOUNDLAND DELEGATION

(xiv) NEWFOUNDLAND RAILWAY

After the date of Union, the Canadian National Railways will be entrusted with the responsibility of operating the Newfoundland Railway and Coastal Steamship Services, and it will be their responsibility to see that the services are furnished commensurate with the traffic offering.[67]

The Sullivan Commission, in its report to the Newfoundland House of Assembly in 1978, argued that the letter from Prime Minister St. Laurent had the effect of modifying the Terms of Union. The Commission took the position that the letter obligated the federal government to maintain the Newfoundland Railway, regardless of cost, as long as there was reasonable demand for its services.[68]

This interpretation of the effect of the letter seems rather doubtful. In the first place, while the courts will no doubt consider material such as parliamentary debates, government reports and other documents,[69] they tend to accord such material minimal weight in assigning meaning to the Constitution.[70] Secondly, St. Laurent's letter specifically distinguished between "government policy" and matters of a "constitutional nature." St. Laurent indicated that the policy and intentions of the government regarding the Newfoundland Railway "are scarcely of a constitutional nature . . . [and] will not form part of the Terms of Union." Thus St. Laurent himself suggested that the undertaking to operate the railway was a political rather than a constitutional commitment and that a conscious decision was made *not* to include this duty in the Terms of Union. Thirdly, St. Laurent indicated that the policy of the government was to entrust the operation of the Newfoundland Railway to CN Rail and that "it will be *their* responsibility" [our emphasis] to see that the services were operated in accordance with the traffic offering. In effect, St. Laurent did not commit the government to ensure the continued or perpetual operation of the railway. The responsibility was to be imposed on CN by the government. The implication is that a subsequent government could decide to modify the terms and conditions under which CN would operate the railway.

This is precisely the approach taken in the federal Order in Council entrusting the operation of the railway to CN on condition that "such management and operation shall continue during the pleasure of the Governor in Council and be subject to termination or variation from time to time in whole or in part by the Governor in Council."[71] Under the terms of the Order, the federal government specifically contemplated the possibility that the operation of the railway would be "terminated . . . in whole or in part." This provision can be contrasted to the terms set out with respect to the operation of the Canadian Pacific Railway, which specifically required the corporation to operate the railway in perpetuity. The absence of any such requirement in the 1949 Order In Council indicates that the government of the day did not believe that it had any constitutional obligation to ensure the perpetual operation of the railway.

A further significant consideration is that in Term 32(1) of the Newfoundland Terms of Union, the federal government specifically undertakes an obligation to maintain a specific transportation service, namely, the ferry service between North Sydney and Port aux Basques.[72] This makes the failure to include any such statement with respect to the Newfoundland Railway all the more decisive.

Although this provision is similar to the ferry service provisions in the P.E.I. Terms of Union, it differs in its stated obligation to maintain the service "in accordance with the traffic offering." The Sullivan Commission in 1978 speculated that there might be circumstances in which traffic would cease to "offer" and that, in such a case, the obligation to provide the service would cease. However, the Commission emphasized that such a situation would be exceptional and would arise only when there was no longer any demand for the service.[73] It is evident that the obligation to provide the ferry service between North Sydney and Port aux Basques is very nearly absolute, similar in practical effect to the obligation regarding ferry service in P.E.I.

Between 1867 and 1873, railway rate regulation by the government was unknown. Rates were regarded as a matter of contract to be left to the determination of the market. Thus the various transportation obligations assumed by the federal government during this early period made no reference to them. By the 1940s, of course, the government had assumed a significant role in regulating railway rates. Thus it is hardly surprising that the Newfoundland Terms of Union would make reference to rates to be charged on the named transportation services. The relevant provisions in Term 32 were as follows:

> (2) For the purpose of railway rate regulation the Island of Newfoundland will be included in the Maritime region of Canada, and through-traffic moving between North Sydney and Port aux Basques will be treated as all-rail traffic.
>
> (3) All legislation of the Parliament of Canada providing for special rates on traffic moving within, into, or out of, the Maritime region will, as far as appropriate, be made applicable to the Island of Newfoundland.

The effect of Term 32(2) was to impose a constitutional cap on railway rates in Newfoundland and on the Port aux Basques ferry. Rates on the Island of Newfoundland itself were to be fixed in accordance with comparable rates in other parts of the Maritimes. Thus, even though transportation in Newfoundland might be more difficult or costly, rates were not permitted to move above the level of rates throughout the Maritimes.[74] Further, Term 32(2) stated that the rates for rail traffic moving on the Port aux Basques ferry were to be set as if the traffic were moving on land rather than by ship.

Term 32(3) has a slightly different impact. This term did not impose an absolute rate cap. Rather, it simply required that any legislation enacted by the Parliament of Canada providing for special or preferential rates for the Maritime region would also be applied to Newfoundland. There is no obligation to enact such legislation, however. Nor is the federal government constitutionally barred from repealing any legislation which it chooses to enact, as long as it treats Newfoundland on a footing identical to that of the other Maritime provinces. Of course, given the long history of preferential freight rates for the Maritimes, dating back to the operation of the Intercolonial Railway, the possibility of repealing such legislation is perhaps more theoretical than real. The point is simply that nothing in the Terms of Union prevents Parliament from amending its legislation, as long as any preferential rates applying in the Maritimes also apply in Newfoundland.

## V. THE PRESENT STATUS OF THE UNDERTAKINGS: THE MOVEMENT FROM POLITICAL TO LEGAL ENFORCEMENT

As we have seen, the original method for enforcement of federal government transportation obligations was political rather than strictly legal. A province that was unhappy with the way in which the federal government was carrying out its responsibilities would typically complain to the federal or imperial authorities. Eventually some compromise solution would be proposed which met the concerns of both levels of government.

In recent years, there has been a slow but discernible shift in the approach to these various constitutional entitlements. Although the transportation obligations set out in the Canadian Constitution continue to be the subject of political negotiations and bargaining compromise between the two levels of government, there is an increasing tendency to seek judicial and legal enforcement of these obligations, rather than to rely exclusively on political avenues of redress. The courts have demonstrated a willingness to take on responsibility for enforcing these obligations, and have assumed an increasingly significant role in their interpretation.

A watershed in this regard was litigation undertaken by the Prince Edward Island government in the mid-1970s following the shutdown of part of the Island ferry during a labour dispute.[75] This case established the proposition that provincial governments could seek enforcement of transportation obligations through the courts. The case also attempted to define the precise legal nature of the obligations and the extent to which it was open to private citizens to seek legal enforcement.

## A. THE PRINCE EDWARD ISLAND FERRY

A nation-wide legal strike by employees of CN Rail in August of 1973 resulted in the shutdown of the ferry service between New Brunswick and P.E.I. for 10 days. Although ferry services were still operating between Nova Scotia and P.E.I. as well as air service to and from the Island, since it was the height of the tourist season, these alternative services were unable to meet the demand. As a result the shutdown had a major negative impact on the Island economy.[76]

The province commenced an action in the Federal Court seeking damages for the losses suffered by the Island during the strike. The province alleged that the federal government had breached its obligation under the P.E.I. Terms of Union to maintain an efficient ferry service linking the Island and the mainland and that the province had a right to compensation for the resulting losses.

The trial judge, Mr. Justice Cattanach, agreed with the province that the federal government had breached its constitutional obligation to provide an efficient ferry service. Holding that an "efficient" service is one that is reasonably capable of meeting the demand for the service, he concluded that there had been a breach of this undertaking during the strike since the service was "wholly inadequate for the need at that time."[77]

However, Mr. Justice Cattanach stated that this breach of obligation did not give rise to an action for damages by the province. In arriving at this conclusion, Cattanach J. distinguished between actions for declaratory relief and actions for damages. He was prepared to grant a mere declaration setting forth the rights and obligations of the Dominion vis-à-vis the province,[78] but he concluded that the province could not succeed in an action claiming monetary compensation for breach of the obligation to provide ferry service. His reasoning was that the obligation was one owed to the public generally rather than for the benefit of any particular individual or class of individuals. Because the obligation had been created for the general public good, Cattanach J. reasoned that no particular person or even province had a right to seek damages for a breach of the obligation.[79]

The Federal Court of Appeal agreed with Justice Cattanach that the federal government had breached its constitutional obligation to provide an efficient ferry service. However, a majority of the Court disagreed with his conclusion that the province could not bring an action for damages. Chief Justice Jackett concluded that the effect of the Terms of Union was to impose a legal duty on "Canada" in favour of "the Province" of Prince Edward Island. He reasoned that when there is a statutory right to have something done, there is an implied right to be compensated for a breach of such right.[80] Jackett C. J. concluded that the province of Prince Edward Island, as opposed to the residents of the Island themselves,[81] had a right to be compensated for losses sustained due to the interruption of ferry service.

In a separate opinion, Mr. Justice Le Dain agreed with this conclusion. He stated that breach of the constitutional obligation to provide ferry service did not permit individual citizens to sue for monetary compensation. However, he was of the view that the provincial government could sue for any loss directly caused to it by the failure to provide efficient ferry service.[82]

In summary, this case established the following three propositions:

1. The constitutional transport obligations set out in the P.E.I. Terms of Union are legally enforceable;
2. In the event that the obligations are not fulfilled, the provincial government has a right to monetary compensation from the Government of Canada for losses resulting from the breach; and
3. It is unlikely that individual citizens have any right to compensation for losses which they might have suffered as a result of the breach of the obligation; the right to compensation is apparently limited to the provincial government alone.

It is important to consider whether the principles set down in *Canada v. P.E.I.* have been modified in any way by the enactment of the *Constitution Act, 1982*. Section 52(1) of the *Constitution Act, 1982* provides that "The Constitution of Canada is the supreme law of Canada, and any law that is inconsistent with the provisions of the Constitution is, to the extent of the inconsistency, of no force or effect." The "Constitution of Canada" is defined in section 52(2) and it includes the BNA Act, 1867, the *British Columbia Terms of Union*, the *Prince Edward Island Terms of Union* and the *Newfoundland Act*.[83] It is evident, in other words, that all of the various provisions establishing transportation obligations of the federal government are included within the meaning of the term the "Constitution of Canada."

Thus, under the terms of section 52, any law that is inconsistent with the constitutional provisions establishing these transportation obligations is of "no force and effect." Any attempt by the Parliament of Canada to modify or reduce its constitutional obligations to provide transportation services is legally invalid. It is clear that a provincial government could seek a declaration of invalidity in accordance with section 52 of the *Constitution Act, 1982*.[84] The only remaining question is whether private individuals could also bring such an action. The Federal Court of Appeal in the *Canada v. P.E.I.* case was of the view that private individuals could not. But an action under section 52 of the *Constitution Act, 1982* is not an attempt to obtain monetary compensation; section 52 simply contemplates the court declaring invalid any law that is inconsistent with the Constitution of Canada.

Courts have taken an increasingly liberal attitude to the question of who has a right to sue for a declaration of constitutional invalidity. The present rule is that a private citizen can maintain an action for a declaration that legislation is invalid if that person can show "that he is affected by it directly or that he has a genuine interest as a citizen in the validity of the legislation and that there is no other reasonable and effective manner in which the issue may be brought before the Court."[85]

There seems to be no reason why this general rule should not be applied in the case of the constitutional provisions relating to transportation. Under this approach, the class of persons who could seek a declaration relating to a particular transportation obligation would be extremely broad and open-ended. Any citizen who was a user or even a potential user of a particular transportation service is affected by a decision to reduce or eliminate that service. It would appear, therefore, that even potential users of the constitutionally mandated transportation services would have legal standing to seek a declaration relating to that service. Nor would the class of potential users (and thus litigants) be limited to the residents of a single province.

As the Federal Court indicated in the *Canada v. P.E.I.* case, the obligation to provide ferry service to P.E.I. is for the benefit of residents on the mainland as well as those on the island.[86] The object of guaranteeing the service is to ensure effective communication *between* the residents of the various provinces. The same can be said of the other transportation undertakings that link provinces. It would appear that any citizen who was a user or potential user of a constitutionally protected transportation service could challenge a decision to reduce that service below the level guaranteed by the Constitution.

The implications of this conclusion may not be as dramatic as might at first be assumed. First, nothing in section 52 of the *Constitution Act, 1982* grants citizens the right to seek monetary compensation in the case of constitutional invalidity. Thus the conclusion of the Federal Court of Appeal in the *Canada v. P.E.I.* case that individual citizens cannot seek financial compensation for breach of a transportation obligation has not been affected by the *Constitution Act, 1982*.

Secondly, and more importantly, the question of standing to sue is a subsidiary one: the determinative question is the scope of the legal obligations themselves. If, as argued earlier, the transportation obligations of the federal government are relatively narrow and circumscribed, then the fact that a broad class of citizens can seek to enforce those obligations is of secondary importance. The key issue, in other words, is the extent of the obligation, rather than who can enforce it.

## B. THE PRINCE EDWARD ISLAND RAILWAY

In 1989, the National Transportation Agency granted an application from CN to abandon all the rail lines on Prince Edward Island.[87] The Prince Edward Island government challenged this Order on the grounds that the P.E.I. Terms of Union imposed an obligation on Canada to operate the railway. The P.E.I. argument relied on the wording of the federal obligation to provide a ferry service: ferry service was to be maintained "thus placing the Island in continuous communication with the Intercolonial Railway and the railway system of the Dominion." The province claimed that this implied an obligation to operate the Island railway as well as the ferry service; without a railway, there would be no way of connecting with the railway system of the Dominion. The Federal Court of Appeal unanimously rejected this argument.[88] Chief Justice Iacobucci (as he then was) held that the only obligation was to provide a ferry service. The reference to the "railway system of the Dominion" in the Terms of Union did not extend this obligation but merely described its effect. Thus there was no constitutional bar to a decision to shut down the railway.[89] It is clear from this decision that the only ongoing transportation obligation relating to Prince Edward

Island is to maintain an efficient ferry service, in accordance with the principles outlined in *Canada v. P.E.I.*[90]

## C. THE NEWFOUNDLAND TRANSPORTATION OBLIGATIONS

At the time of Newfoundland's entry into Confederation, the Newfoundland Railway was the only reliable means of overland transportation across the province. On a narrow gauge rail with many steep grades and severe curves, it normally took between 22 and 30 hours to make the 547-mile trip from St. John's to Port aux Basques. Passenger traffic on the railway began to fall off in 1960 and then dropped off substantially after 1965 when the Trans-Canada Highway was completed. The cost of converting the railway to standard gauge or otherwise to improve it was found prohibitive.[91]

In 1967, CN applied to the Canadian Transport Commission (CTC) to discontinue the passenger train service and begin operating a bus service instead. The Roadcruiser bus service was said by CN to be more efficient and convenient than the train service it was to replace. The Railway Transport Committee of the CTC approved the application but adopted what it termed a "large and liberal interpretation" of the Newfoundland Terms of Union so as to give it "the flexibility that changing or unforeseen circumstances may require."[92] According to the Committee, there was a "presumption" under the Terms of Union that public transportation service for passengers between St. John's and Port aux Basques "should be assured so long as it is required by public convenience and necessity." Because of this presumption, the Committee attached a number of conditions to its Order, the most important being that the CN must maintain the bus service "as long as a requirement for passenger service continues."[93]

This interpretation of the transportation obligations of the federal government was indeed both expansive and novel. The relevant provisions in the Terms of Union merely specify that the federal government is to take over the Newfoundland Railway. There is no stated requirement to operate the railway, in contrast to the provision requiring continued operation of a ferry service across the Cabot Strait. The Railway Committee did not interpret the Terms of Union as requiring the maintenance of a passenger rail service *per se*. Rather, it held that the federal government was required to maintain some form of public transportation service which would meet the needs of the residents of Newfoundland.

Canadian National has continued to operate the Roadcruiser bus service in accordance with requirements established by the Canadian Transport Commission and its successor, the National Transportation Agency. While a wholly intra-provincial bus service, it falls under federal jurisdiction due to its close integration with the Newfoundland Railway system.[94]

Although CN discontinued its passenger rail service in Newfoundland in 1969, it continued its freight service on the Newfoundland Railway system. But freight service became increasingly unprofitable, particularly as a result of growing competition from truck transportation on the Trans-Canada Highway. A Provincial Commission of Inquiry into Newfoundland Transportation appointed in the mid-1970s found that the railway could not continue as a viable service.[95] The Commission recommended that the railway system be phased out entirely over a 10-year period. Both the provincial and federal governments rejected this recommendation and instead undertook a major revitalization freight transport program for the railway. Despite these efforts, the railway's losses mounted to over $40 million annually in the early 1980s while its market share continued to decline. By 1987, the railway's share of total freight traffic in the province had fallen to 20 percent, and was projected to decline further.[96]

In 1988, the federal and provincial governments signed a Memorandum of Understanding providing for the phase-out of the Newfoundland Railway on September 1, 1988. Under the terms of the Agreement, the federal government was to provide over $800 million for the improvement of roads and port facilities as well as for labour and community adjustment.[97] The Memorandum of Understanding also provided that the federal payments were offered "in full satisfaction of all Canada's constitutional obligations related to railways on the Island of Newfoundland. . ." [paragraph 10(1)]. Under the Agreement, the province stated that Canada had met all of its constitutional obligations relating to railways on the Island of Newfoundland. In accordance with the terms, the Newfoundland Railway ceased operations, and has been largely dismantled; track and ties have been lifted and the right-of-way returned to its original state.[98]

It is a basic principle of Canadian constitutional law that governments cannot alter the Constitution through mere agreement.[99] Indeed, the Supreme Court of Canada has recently determined that intergovernmental agreements are subject to repeal or abrogation by statute.[100] Thus it is clear that the

Memorandum of Understanding cannot have the effect of altering any constitutional obligations which the federal government might have with respect to the operation of the Newfoundland Railway. However, as this report suggests throughout, the federal government has never been under a constitutional obligation to maintain or operate the Newfoundland Railway. This interpretation flows from the Terms of Union themselves, which merely provide that the Government of Canada is to "take over" the railway. The absence of any requirement to maintain the service means that there is no constitutional objection to a decision to close down the railway.

This interpretation of the Terms of Union was explicitly endorsed by the Premier of Newfoundland, the Honourable Brian Peckford, at the time of the signing of the Memorandum of Understanding. Premier Peckford offered the following comments:

> We have assessed the legal intent and obligations imposed on the federal government by the Terms of Union. It is clear that the Government of Canada does not have a legal obligation to operate a railway in Newfoundland forever. We have always felt, however, that the federal government does have an obligation to ensure that there is a viable transportation system in this province. This agreement today constitutes our mutual recognition that this comprehensive transportation package meets that obligation.[101]

In the period since the shutdown of the Newfoundland Railway, the National Transportation Agency has had occasion to interpret and apply the transportation obligations in the Terms of Union. In its conclusions, the Agency has simply assumed that the 1988 shutdown was perfectly lawful and consistent with the Terms of Union. For example, the Agency recently was asked to interpret the meaning of section 32(2) of the Terms of Union in light of the shutdown of the railway. There was no suggestion that the decision to shut down the railway was in any sense a violation of the Terms of Union.

All of these factors confirm the conclusion that the federal government had no constitutional obligation to maintain the Newfoundland Railway. Accordingly, it would seem that the termination of the railway in 1988 did not violate any of the constitutional obligations of the federal government under the Newfoundland Terms of Union.

The remaining question is how the shutdown of the railway may have affected the other transportation obligations in the Terms of Union. Of particular interest in this regard is Term 32(2), which provides that "for the purpose of railway rate regulation the Island of Newfoundland will be included in the Maritime region of Canada. . . ." The problem is that, while Term 32(2) specifically refers to "railway rate regulation," there is no longer a railway system in Newfoundland. Does that mean that the shutdown of the railway has somehow rendered Term 32(2) redundant or inapplicable? The National Transportation Agency's unanimous decision was that Term 32(2) continued to apply despite the shutdown of the railway.[102] Although there is no longer a railway in Newfoundland, there are still "railway rates" which are to be developed by CN and applied in accordance with Term 32(2). The Agency ruled that Terms of Union rates should be developed using rail mileage through North Sydney to Port aux Basques and onto St. John's as if the Newfoundland Railway were still in place. The Agency made it clear, however, that such rates constitute a "ceiling" only and there is no prohibition on CN charging rates lower than the Terms of Union rate, as long as such rates satisfy the other requirements of the *National Transportation Act, 1987*.

While the Agency has determined that Term 32(2) continues to apply as a matter of strict law, other developments in the transportation marketplace are reducing its practical impact and importance. Term 32(2) only protects marine traffic moving over a named route from North Sydney to Port aux Basques. At the time of the negotiation of the Terms of Union in 1949 this was the main marine connection between Newfoundland and the Canadian mainland. However, in recent years there has been a dramatic shift in traffic patterns to the Island of Newfoundland such that only about 25 percent of CN's traffic to Newfoundland now moves over the North Sydney–Port aux Basques gateway. The vast bulk of CN's traffic moves between Halifax and St. John's, a route that is more efficient and less costly for shippers. Technology and the transportation marketplace are thus rendering the protections of Term 32 increasingly redundant from a practical point of view.

A further development which has reduced the practical significance of Term 32(2) is the advent of confidential contracting under the *National Transportation Act, 1987*. The vast bulk of goods now moves at rates that are significantly less than published railway tariffs. Upwards of 65 percent of revenue traffic moving to Newfoundland now moves under confidential contracts.[103] Because the terms of these contracts are private, it is becoming increasingly difficult to establish a benchmark Terms of Union rate that reflects the actual costs of moving goods to and from Newfoundland.[104] It would appear that the majority of goods moving to Newfoundland does so at rates well below the constitutional "ceiling" established by the Terms of Union.

The Newfoundland situation can be contrasted with that prevailing in Prince Edward Island. Under the P.E.I. Terms of Union there is no restriction on the rates that may be charged for the ferry service linking the Island with the mainland. Accordingly, any limitations on the rates for the P.E.I. ferry service are political and economic, rather than constitutional. Only Newfoundland has an explicit constitutional guarantee with respect to freight rates on the Sydney to Port aux Basques ferry and on the Island of Newfoundland itself.

## D. THE VANCOUVER ISLAND RAILWAY

As previously described, in 1883 the governments of Canada and British Columbia agreed to settle their differences over the delays in the construction of the Canadian Pacific Railway. As part of this settlement, there was an agreement as to the manner of construction of a railway on Vancouver Island between Esquimalt and Nanaimo. The province agreed to make certain land grants in favour of the federal government on completion of the railway. The Government of Canada was to designate and contract with the persons who would build the railway, to transfer the land grant to these persons, and to contribute $750,000 towards the cost of construction. The Canada-B.C. Agreement, which was ratified by legislation passed by both governments, made no provision for the manner in which the railway was to be operated upon its completion.

As already mentioned, pursuant to the Agreement, Canada contracted with a third-party syndicate (the Dunsmuir Syndicate) to build and operate the railway "continuously and in good faith." The Canada-Dunsmuir Agreement was appended as a schedule to the federal Act of 1884 ratifying the settlement with the province.

The 70-mile stretch of railway was completed in 1886. The rights and obligations of the Dunsmuir Syndicate were transferred to the Esquimalt and Nanaimo Railway Company and later to the Canadian Pacific Railway

Company. Upon CPR assuming control in 1905, the railway was declared to be a work for the general advantage of Canada and came under federal regulatory authority.

Rail service continued to be offered until late 1989, when the federal Cabinet terminated passenger rail service on this line. The province sought a declaration from the British Columbia Supreme Court that the federal government was obliged to provide the service in perpetuity. The province argued that the obligation to operate the railway "continuously and in good faith" was constitutionally binding on the federal government. The province had to surmount two very large obstacles to succeed with this argument: the first was that nothing in the B.C. Terms of Union obliged the federal government to operate either the Canadian Pacific Railway or the branch line on Vancouver Island.[105] Secondly, nothing in the 1883 Settlement Agreement between Canada and British Columbia obliged the federal government to operate the Island railway. The only commitment regarding the operation of the Island railway is found in the Agreement between Canada and the Dunsmuir Syndicate. The promise to operate the railway "continuously and in good faith" was made to the federal government rather than to the province.

Despite these seemingly persuasive objections to the provincial argument, Mr. Justice Esson of the B.C. Supreme Court found that the federal government had a perpetual obligation to operate the Vancouver Island Railway. With respect to the 1883 Canada-B.C. Settlement Agreement, Esson J. acknowledged that the federal government had not promised to operate the railway continuously. However, he was of the view that the province had relied on the undertaking of continuous operation which the Dunsmuir Syndicate had given to the federal government. Therefore, the promise to operate the railway continuously was a benefit "which the Dominion impliedly offered to maintain for the benefit of the province."[106] This "implied offer" became binding on the federal government when the province carried out its part of the bargain, particularly the "very onerous terms relating to the land grant."

Mr. Justice Esson went on to conclude that the 1883 Agreement had "constitutional force" and could not be unilaterally amended by the federal government. The basis for this conclusion appears to be that the 1883 Agreement was "part of the constitutional compact under which British Columbia became part and parcel of the Dominion."[107] He further relies on the "intentions" of the two governments in 1871 and 1883 as a basis for finding an obligation to operate the railway indefinitely:

> In 1871 no one would have thought that, if the railway was built, it would not operate in perpetuity. As between the two levels of government, it was unnecessary to stipulate that both would have the benefit of the covenant to operate — enough that the promise was given to the Dominion by the contractors and the railway company. I infer from all the circumstances that the province relied upon the Dominion to enforce that obligation.

What is most striking about this passage is that it makes no distinction between the construction of the island railway and the main line of the CPR. According to Esson J., the assumption *in 1871* was that if the railway was built it would operate in perpetuity. But the railway that was under contemplation in 1871 was not the Island railway; rather, it was the transcontinental railway linking B.C. with the rest of Canada. The logical implication flowing from Justice Esson's reasoning is that the federal government has an obligation to operate *the whole of the Canadian Pacific Railway system in perpetuity*, not simply the 70-mile stretch of rail on Vancouver Island.

This conclusion is not as improbable as it might at first glance appear. It is important to remember that the CPR gave an undertaking of continuous operation to the federal government similar to that made by the Dunsmuir Syndicate. The federal legislation establishing the CPR required the corporation to run the whole of the transcontinental railway system in perpetuity; the wording in the case of the CPR is even more definitive and unambiguous than it was with respect to the Island railway.[108] Thus, if B.C. is entitled to rely on the undertaking with respect to continuous operation of the island railway, there would seem to be no reason preventing it from also relying upon the promise of perpetual operation of the CPR.

Thus Mr. Justice Esson's interpretation of the B.C. Terms of Union and the 1883 Settlement Agreement has important implications for the whole of the CPR, not just the rail line on Vancouver Island. Under the approach adopted by Mr. Justice Esson, a variety of other federal government orders shutting down or reducing passenger service on the CPR would come into question.

Yet there are a number of difficulties associated with the reasoning of the Court in this case. These difficulties include the following:

(i) The legislative history of the B.C. Terms of Union indicates that the federal government's obligation was to construct the CPR, but not to operate it; of particular significance is the fact that there are references to a requirement to "maintain" services elsewhere in the Terms of Union, but no such obligation was included with respect to the CPR;

(ii) This interpretation places British Columbia on the same footing as the other provinces in Canada; the federal government has assumed responsibility for constructing or taking over a variety of other railways, but in no instance has it agreed to operate these railways in perpetuity. The decision to shut down the P.E.I. and Newfoundland railways has been accepted by the courts and/or the province concerned as perfectly lawful. To hold otherwise in the case of British Columbia is to place that province in a preferred and unique position with regard to railway operation; and

(iii) Whatever may have been the intentions surrounding the Canada-B.C. Settlement in 1883, the Agreement did not amount to an amendment of the Terms of Union. Governments cannot alter the Constitution through mere agreement.[109] Thus, even assuming that the 1883 Canada-B.C. Agreement included a promise to operate the railway in perpetuity, such a promise is not constitutionally binding. The 1883 Agreement is not part of the "Constitution of Canada"[110] and thus cannot amount to a fetter on the legislative authority of the Parliament of Canada.

Notwithstanding these objections, a five-member panel of the British Columbia Court of Appeal unanimously upheld Mr. Justice Esson's conclusions in a judgement handed down on October 4, 1991.[111] The Court of Appeal concluded that Canada had a continuing constitutional obligation to British Columbia to ensure the maintenance of passenger and freight rail service on the rail line between Victoria and Nanaimo. While the Court of Appeal found that the obligation was "continuous" it refused to describe the obligation as "perpetual";[112] it also indicated that the service could be discontinued with the agreement of the Government of British Columbia.

The major focus of the Court of Appeal's reasoning dealt with whether the construction of the Vancouver Island Railway was part of the original Term 11 obligation of Canada. The Court of Appeal reasoned that the construction of the Island portion of the railway was indeed included within the constitutional obligation defined by Term 11. The Court of Appeal suggested that the wording of Term 11, which referred to the construction of a railway to the "Seaboard" of British Columbia, was ambiguous; in the Court's view, this might be read so as to include the construction of a railway line on Vancouver Island. The Court of Appeal relied particularly on an 1873 Order in Council passed by the Government of Canada fixing Esquimalt as the western terminus of the Canadian Pacific Railway. In the Court's view, this was the "best evidence of the intention and understanding of the parties about Canada's Term 11 obligations."[113]

Having found that the obligation defined by Term 11 included the construction of the rail line on Vancouver Island, the Court of Appeal went on to find that the 1883 Settlement arrangements were of a "constitutional nature." In the Court's view, Term 11 was a "skeletal" provision which was "worked out" through the various covenants associated with the 1883 Settlement.[114] These covenants included the undertaking given by the Dunsmuir Syndicate to operate the Vancouver Island Railway "continuously." This meant that this covenant was of a constitutional nature and could not be varied except with the consent of the Government of British Columbia.[115]

To what extent does the Court's reasoning in this case have wider implications for other transportation obligations of the Canadian government? As already noted, the reasoning of Mr. Justice Esson would seem to imply an obligation to maintain perpetual operation of the whole of the Canadian Pacific Railway. This implication is strengthened by the reasoning of the Court of Appeal in this case. The Court of Appeal reiterates at numerous points in its judgement that the island railway is "constitutionally indistinguishable from the Mainland railway."[116] The Court of Appeal also implies that Term 11 itself carr[illegible] with it some kind of continuing obligation:

> Canada assumed a constitutional obligation to British Columbia, and indeed to all of Canada, to ensure the continuation of the arrangements made to carry the Terms of Union into effect for the benefit of all its citizens. *It is untenable, in our view, to argue that Term 11 was spent once the last spike on the Mainland Railway was driven.* [emphasis added][117]

The Court's theory that Term 11 is a "skeletal" provision only which was to be "worked out" through subsequent enactments also supports the conclusion that the whole of the CPR must be operated in perpetuity. As noted above, the 1881 statute creating the CPR stated that the railway must be operated "forever" by the company. This statutory language could be said to be evidence of what the Court of Appeal identified as an obligation to "ensure the continuation of the arrangements made to carry the Terms of Union into effect for the benefit of all its citizens."

In summary, the implications of the litigation surrounding the Vancouver Island Railway extend far beyond the particular issues raised in the case. The reasoning of both the trial judge and the Court of Appeal supports the conclusion that the federal government has a constitutional obligation to maintain the whole of the Canadian Pacific Railway.[118] Given these very broad implications, it would seem an appropriate matter for review by the Supreme Court of Canada.[119]

The recent litigation on this issue has injected some uncertainty into the precise scope and meaning of Term 11 of the B.C. Terms of Union. The other terms seem straightforward: under Term 4, the federal government is obligated to provide efficient mail service between Victoria and both San Francisco and Olympia. As we noted earlier, the federal approach was to contract with private operators to provide this service and to pay subsidies. Beginning in 1925, a federal subsidy directed towards supporting a ferry service to San Francisco was used by the province to support mail service within the province.

In the 1970s, British Columbia complained that the federal subsidies paid to support ferry service in British Columbia were lower than comparable subsidies paid in the Maritimes. As a result, in 1977 the province and the federal government entered into a new arrangement for ferry subsidies. Under the 1977 Subsidy Agreement,[120] the federal government agreed to pay a block grant of some $8 million annually to the province for support of ferry service. In return for this subsidy, Canada was to be relieved of "any and all obligations for the provision of subsidy or other financial assistance over and above the subsidy provided for in this Agreement" (section 5). It would be up to the province to determine how the federal grant should be used. However, the province agreed to "assure reasonable and adequate service and appropriate supervision thereof" in B.C. coastal waters (section 4(2)). The province was also obliged under the Agreement to "place appropriate passenger vessels in service . . . to give effective links where required on the coast between communities and principal water and air services" (section 4(3)).

An effective and efficient ferry system has been maintained in the province pursuant to this Agreement. Thus the requirements of the Terms of Union in this regard are currently being satisfied. But the constitutional obligation to provide the service remains that of the federal government rather than the province. The provisions in the Subsidy Agreement imposing obligations on the provincial government are subject to the constitutional requirements of the Terms of Union, which continue to apply.

## VI. CONCLUSIONS

The first important conclusion is that the ongoing obligations of the federal government are relatively limited and circumscribed. All of the obligations relating to the construction of various railways in different provinces of Canada have long since been satisfied. As suggested, there is no continuing obligation to operate any of these rail services[121] nor is there any constitutional limitation on the manner in which the services are to be provided. The only continuing obligations of the federal government would appear to fall into two categories:

(i) The federal government is obliged to provide the ferry services guaranteed to British Columbia, Prince Edward Island and Newfoundland under the Terms of Union for these particular provinces. Further, it is obliged to maintain passenger and freight rail service on the Island railway on Vancouver Island, pending a final court determination of this issue;

(ii) There is a limitation on the rates which can be charged to Newfoundland in accordance with terms 32(2) and 32(3) of the Newfoundland Terms of Union. It should be noted that this is the only constitutional limitation respecting rates; there is no constitutional constraint on cost recovery in respect of the other mandated ferry services.

The relevant province is entitled to undertake legal action to enforce these ongoing obligations. In addition, the province can seek monetary compensation for any losses which it might have suffered due to interruption of the guaranteed service. It would appear that private citizens who are affected by breach of a constitutional obligation are also entitled to bring legal action to enforce it. However, it is unlikely that a private citizen would be permitted to obtain monetary compensation for any losses suffered due to a breach of a constitutional obligation. The private citizen could only obtain a declaration of his or her rights with respect to the transportation service in question.

If this first conclusion is correct, then these limited transportation obligations in the Canadian Constitution ought not to be a significant concern for transportation policy makers. Their extremely restricted scope and impact clearly do not represent a significant impediment to the development of a modern and integrated transportation system for Canada.

In one sense, it might be concluded that the inclusion of these transportation obligations in the Constitution was a success; the existence of these undertakings played a key role in the creation of the Canadian State. The critical feature of the undertakings was their binding and enduring character. Because they were incorporated in imperial legislation, successive Canadian governments were obliged to make good on the original undertaking. This provided the colonial leadership in the 1860s and 1870s with the assurances it needed to support political union.

But there are disadvantages to including provisions of this type in a constitution. A constitution is intended to provide a general framework which can be adapted to fit the changing needs and circumstances of state and society. The transportation undertakings set out in the Canadian Constitution are not of this general character. Rather, they set out quite precise commitments to provide certain transportation services, including in some cases the time and manner in which the service is to be carried out. The problem with this type of constitutional provision is not simply that it is out of character with the generality of the constitution as a whole. The real difficulty is that the more specific a constitutional provision, the more difficult it is to adapt that provision to changing circumstances or needs.

One risk is that the provision will simply be rendered meaningless or superfluous by the changing current of events. An illustration of this is the guarantee of preferential rates on the North Sydney to Port aux Basques ferry in the Newfoundland Terms of Union. While this route was once the main gateway to Newfoundland, changes in technology are rendering it increasingly marginal to Newfoundland's transportation system.

But a second risk, by far more worrisome, is that the courts will attempt to apply a particular provision to changing circumstances in a novel or unforeseen way. One possibility is that the courts will insist that a particular mode of transportation must be used, regardless of its relative cost or efficiency. In effect, the courts would attempt to "freeze" the evolution of the transportation system and prevent the movement to more efficient and cost-effective modes. For example, there has been discussion over the years of the possibility of establishing some form of fixed link between Prince Edward Island and the Canadian mainland. Were this fixed link ever constructed, it might render the continuation of ferry service over the same route superfluous. However, the existence of a constitutionally mandated obligation to provide a ferry service would likely prevent governments from discontinuing the service, even though it would have outlived its usefulness.

Of course, even in a case where the courts required the continued use of an inefficient or uneconomic mode of transportation, it would still be open to governments to amend the Constitution.[122] On the other hand, constitutional amendment in Canada is never a simple or straightforward matter, as the events of the past decade have shown.

On balance, therefore, there would appear to be significant disadvantages associated with the constitutional entrenchment of entitlements to specific transportation services. It is no accident that the practice of including such obligations in the Canadian Constitution has been limited to a means of securing the entry of individual provinces or groups of provinces to Canada. Once a province was created, however, there is no instance where its constitutional entitlement to transportation services has been expanded. Instead, transportation services involving particular provinces have been provided for through ordinary legislation or federal-provincial negotiation and agreement. There has been no willingness to entrench any further entitlements in the Constitution. The inclusion of these provisions is clearly anomalous, for the reasons given above. The exceptional character of the existing constitutional transportation obligations is all the more apparent in light of the enactment of the *Constitution Act, 1982*. The entitlements to specific transportation obligations are now included as part of the "Supreme law of Canada" and any laws which are inconsistent with this fundamental law are of no force and effect.

It is to be expected that provincial entitlement to transportation services will continue to be dealt with largely through ordinary legislation and federal-provincial agreement. No province has sought to entrench further entitlements to transportation services in the Constitution. At the same time, the recent Supreme Court case dealing with the enforceability of federal-provincial agreements[123] may cause some provinces to demand some mechanism to bind the federal government to meet its contractual obligations.

The answer to this concern is not, as has sometimes been suggested, to entrench federal-provincial agreements directly in the Constitution. As argued above, the constitutional entrenchment of what amount to contractual commitments between the two levels of government can have effects that are both unanticipated and unsatisfactory. A better solution to this potential problem[124] is to use the mechanism which was provided under the Meech Lake Accord with respect to immigration: any province which negotiated an agreement with the federal government regarding immigration could have the agreement protected from unilateral amendment by the federal government.[125] This approach, which falls short of entrenching the agreement itself as part of the Constitution, could be applied more generally. In transportation, for example, it could provide a mechanism to ensure that federal government undertakings were legally enforceable. It would also provide an answer to any provincial concerns regarding the uncertain legal status of agreements with the Government of Canada.

## ENDNOTES

I am indebted to Mr. Christopher Morrison, a member of the Osgoode Hall class of 1993, for his excellent research assistance in the preparation of this paper.

1. G. P. de T. Glazebrook, *A History of Transportation in Canada*, Vol. 1, (Toronto: McClelland and Stewart, 1964), p. xiii.

2. See, for example, the guarantee in the B.C. Terms of Union that Canada will provide "an efficient mail service, fortnightly, by steam communication between Victoria and San Francisco, and twice a week between Victoria and Olympia; the vessels to be adapted for the conveyance of freight and passengers." B.C. Terms of Union, section 4.

3. The single most significant and costly transportation obligation was, of course, the undertaking to construct a transcontinental railway linking British Columbia with the other provinces within 10 years of its entry into Confederation. See B.C. Terms of Union, section 11.

4. See, for example, the essays in K. W. Studnicki-Gizbert, *Issues in Canadian Transport Policy* (Toronto: Macmillan of Canada, 1973) which omit any discussion of constitutional transport obligations as a significant factor in contemporary transport policy. See also C. Dalfen and L. Dunbar, "Transportation and Communications: The Constitution and the Canadian Economic Union," in *Case Studies in the Division of Powers*, Vol. 62, ed. Mark Krasnick (Royal Commission on the Economic Union and Development Prospects for Canada, Background Studies, 1985) which makes no mention of the federal obligations to provide transportation services.

5. See *Prince Edward Island (Minister of Transportation and Public Works) v. Canadian National Railway Co.* [1991] 1 F.C. 129.

6. See *Attorney General of British Columbia v. Attorney General of Canada* 42 B.C.L.R. (2d) 339 (1989).

7. See *Attorney General of British Columbia v. Attorney General of Canada* (Reasons for Judgment of the Court of Appeal for British Columbia, October 4, 1991, unreported).

8. It is important to distinguish constitutional transportation obligations from constitutional *jurisdiction* relating to transportation. Constitutional jurisdiction grants authority to deal with a particular matter, without specifying how that authority is to be exercised; a constitutional obligation imposes a duty to deal with a particular matter in a particular fashion. This study examines the transportation obligations imposed on the federal government under the Canadian Constitution.

9. P. B. Waite, *The Life and Times of Confederation* (Toronto: University of Toronto Press, 1967).

10. Glazebrook, p. 14.

11. It should be noted that the delegates from Prince Edward Island were opposed to the Intercolonial, regarding it as a cause for additional taxation of Island residents without any corresponding benefit. Thus the reference to "Maritime" support for the Intercolonial is limited to the provinces of New Brunswick and Nova Scotia.

12. G. P. Browne, ed., "Quebec Resolutions," *Documents on the Confederation of British North America* (Toronto: McClelland and Stewart, 1969), p. 165.

13. Ibid. p. 165.

14. The various drafts of the sections of the BNA Act setting out the commitment to build the Intercolonial are found in Browne, p. 278 and pp. 335–36.

15. Earlier drafts of the bill had contemplated specifying a date for completion of the railway; see Browne, p. 278 (3rd draft of bill, 2 February 1867).

16. S. Fleming, *The Intercolonial* (Montreal: Dawson Brothers, 1876), p. 76.

17. See section 146 of the BNA Act, 1867.

18. See section 2 of the *Manitoba Act, 1870.*

19. Rupert's Land and North-Western Territory Order, 1870 (U.K.), R.S.C. 1970, Appendix II, no. 9.

20. The text of the B.C. proposal was as follows:

> 8. Inasmuch as no real union can subsist between this Colony and Canada without the speedy establishment of communications across the Rocky Mountains by Coach Road and Railway, the Dominion shall, within three years from the date of union, construct and open for traffic such Coach Road from some point on the line of the Main Trunk Road of this Colony to Fort Garry, of similar character to the said Main Trunk Road; and shall further engage to use all means in her power to complete such Railway communication at the earliest practicable date, and that Surveys to determine the proper line for such Railway shall be at once commenced; and that a sum of not less than One Million Dollars shall be expended in every year, from and after three years from the date of union, in actually constructing the initial sections of such Railway from the Seaboard of British Columbia to connect with the Railway system of Canada.

*Papers in Connection with the Construction of the Canadian Pacific Railway* (Carnarvon Papers), Vol. I, no. 2. (1890).

21. See Glazebrook, pp. 48–49.

22. Note, however, that the obligation in Term 11 was merely imposed on the "Government of the Dominion" rather than upon "Parliament," as was the case with the Intercolonial. This indicates that the obligation in Term 11 does not bind Parliament directly in the sense that it does not oblige Parliament actually to enact legislation. Of course, Term 11 is still "constitutionally entrenched" in the sense that any legislation which Parliament does enact must not conflict with its provisions. Further, the courts will rely on Term 11 to strike down any legislation which is inconsistent with its terms. See discussion *infra*, pp. 36 and 56.

23. See, i.e. Glazebrook, p. 47.

24. *Debate on the Subject of Confederation with Canada*, Victoria, B.C. (G.P.O., 1870), p. 92.

25. *Carnarvon Papers*, Vol. 1, no. 2, clause 10.

26. See clause 7 (re San Francisco) and clause 10 (re coastal mail service) of the original B.C. proposals, reprinted in *Carnarvon Papers*, Vol. 1, no. 2, pp. 140–41.

27. *Debate on the Subject of Confederation with Canada*, Victoria, B.C., p. 78.

28. This issue was not raised in the B.C. debates on the terms; no notice is taken of the difference in the wording proposed for the service to San Francisco as opposed to the service to Olympia. Thus it is impossible to state whether the drafters of the B.C. proposal envisaged that the requirement to "supply" the ferry service to San Francisco would terminate at some point.

29. In addition to the obligations outlined above, the Canadian government also undertook to guarantee for 10 years the interest on a loan for the construction of a "first-class Graving Dock" at Esquimalt. Note that here the obligation was limited to the guarantee of interest; Canada did not have to construct or secure the construction of the Graving Dock. See Term 12 of the Terms of Union.

30. For a full account of P.E.I.'s opposition to the Quebec resolutions, see F. W. P. Bolger, *Prince Edward Island and Confederation* (Charlottetown: St. Dunstan's University Press, 1964), pp. 89–107.

31. See Bolger, p. 201.

32. For an account of the public reaction to the 1869 Canadian offer and the demand for construction of an Island railway as the price for entering Confederation see Bolger, pp. 202–13.

33. Bolger, p. 217.

34. Ibid., p. 235.

35. The Terms of Union provided as follows: "That the railways under contract and in the course of construction for the Government of the Island, shall be the property of Canada."

36. The Island's debt stood at approximately $3.7 million while the "debt allowance" amounted to over $4.7 million.

37. The relevant term provided that: "Efficient Steam Service for the conveyance of mails and passengers, to be established and maintained between the Island and the mainland of the Dominion, Winter and Summer, thus placing the Island in continuous communication with the Intercolonial railway and the railway system of the Dominion."

38. Indeed, this point was noted during the debates in the P.E.I. Legislative Council on the proposed Terms of Union. One of the members objected to the fact that there was nothing in the terms requiring Canada to keep the railway in operation. The Premier replied that this was indeed the case, but that the inclusion of such a requirement was regarded as unnecessary. See *Debates and Proceedings of the Legislative Council of Prince Edward Island for the Session of 1873*, May 1, 1873, (Charlottetown: Queen's Printer), pp. 49–50.

39. See *Debates and Proceedings of the Legislative Council of Prince Edward Island for the Session of 1873*, p. 67.

40. This was added to the terms at the very end of the negotiations and was one of the final concessions from Canada which secured the support of the Island government. See Bolger, p. 279.

41. Canada also agreed to take a dredge boat that was under construction at a cost of up to $22,000. However, there was no obligation on the part of Canada beyond the mere purchase of the boat.

42. S.C. 1867, c. 13.

43. See E. Forbes, *The Maritime Rights Movement: A Study in Canadian Regionalism* (Montreal: McGill-Queen's University Press, 1979).

44. The increased cost of construction was attributable to a variety of causes, not the least of which was incompetence and mismanagement by the Federal Board of Commissioners. See G. R. Stevens, *Canadian National Railways*, Vol. 1 (Toronto: Clark, Irwin, 1960), pp. 192–203.

45. See *An Act to amend the Act respecting the construction of the Intercolonial Railway*, S.C. 1874, c. 15.

46. See *An Act to incorporate Canadian National Railway Company*, S.C. 1919, c. 13.

47. The story is well known and will not be recounted here. See, e.g. D. Creighton, *John A. Macdonald: The Old Chieftain* (Toronto: Macmillan, 1955), and H. A. Innis, *A History of the Canadian Pacific Railway* (Toronto: University of Toronto Press, 1971).

48. The wording of Term 11 itself did not support this contention. Term 11 provided that the railway would connect the "Seaboard" of British Columbia with the railway system of Canada: there is no mention of a railway on Vancouver Island. Notwithstanding the wording of Term 11, the Macdonald Government had passed an Order in Council in 1873 fixing Esquimalt on Vancouver Island as the terminus of the Canadian Pacific Railway. It was apparently contemplated that a bridge would be constructed between the mainland and Vancouver Island near Nanaimo, and a line of railway would then be built on the Island from Nanaimo to Esquimalt. The plans for the bridge across Seymour Narrows never materialized.

49. See *Carnarvon Papers*, for the history of the negotiations between 1873 and 1883.

50. The Agreement dealt with a variety of matters in addition to the issue of the Island railway. For example, a change in the route of the CPR through the Rockies had resulted in the land grant in that area consisting of barren and mountainous country. The province agreed to provide compensation for the low value of this land by conveying a huge block of land (3.5 million acres) in the Peace River area. The Agreement also dealt with the terms and conditions respecting the sale of railway lands to the public.

51. Note that under the terms of the Settlement Agreement, the federal government itself did not undertake the obligation to construct the railway line. Its obligation was simply to transfer lands to the railway contractors, to pay a subsidy of $750,000 and to take security from the contractors in order to ensure that the contractors would complete the line on schedule. See section (e) of the Settlement Agreement.

52. See *An Act relating to the Island Railway, the Graving Dock and Railway Lands of the Province*, S.B.C. 1884, c. 14, and *An Act respecting the Vancouver Island Railway, the Esquimalt Graving Dock, and certain Railway Lands of the Province of British Columbia*, granted to the Dominion, S.C. 1884, c. 6.

53. Section 16 of the contract provided:

> The Canadian Pacific Railway, and all stations and station grounds, work shops, buildings, yards and other property, rolling stock and appurtenances required and used for the construction and working thereof, and the capital stock of the Company, shall be forever free from taxation by the Dominion, or by any Province hereafter to be established, or by any Municipal Corporation therein; and the lands of the Company, in the North-West Territories, until they are either sold or occupied, shall also be free from such taxation for 20 years after the grant thereof from the Crown.

54. See section 7. The obligation of the railway in this case was more clearly expressed than in the case of the Agreement with the Dunsmuir Syndicate regarding the Island railway. The obligation imposed on the CPR to operate the main line of railway "thereafter and forever" did not appear in the Agreement with the Dunsmuir group. The significance of this wording will be explored later in this paper in connection with the recent B.C. court decision on the operation of the Island railway.

55. See *An Act respecting the Canadian Pacific Railway*, S.C. 1881, c. 1.

56. See, e.g. *Esquimalt and Nanaimo Ry. v. A.G.B.C.* [1950] A.C. 87, dealing with the scope of the tax exemption for the lands owned by the CPR on Vancouver Island.

57. The British Columbia courts have recently held otherwise, concluding that certain statutory provisions dealing with the operation of the Vancouver Island Railway have become constitutionally entrenched. This case and its implications will be discussed later in section V of this paper.

58. See [1950] A.C. 87.

59. An exception arose in the case of Saskatchewan and Alberta in 1905. The federal statutes creating those provinces included the tax exemption granted to the CPR under the 1881 contract. (See section 24 of both the *Alberta Act* and the *Saskatchewan Act*, reproducing section 16 of the contract between the CPR and the Government of Canada). These federal statutes became constitutionally entrenched as part of the Constitution of Canada in 1982 and now have full constitutional force and effect. This means they can only be modified in accordance with the amending formula set out in part V of the *Constitution Act, 1982*.

60. See "Report of the Deputy Minister of Trade and Commerce," p. 39 in *The Thirty-fifth Annual Report of the Department of Trade and Commerce for the fiscal year ending March 31, 1927*.

61. Ibid.

62. The terms of the P.E.I. memorial are described in detail by Mr. Justice Cattanach in *The Queen in Right of the Province of Prince Edward Island v. The Queen in Right of Canada* [1976] 2 F.C. 712, p. 718.

63. S.C. 1901, c. 3, s.1.

64. See *The Prince Edward Island Subsidy Act, 1912*, S.C. 1912, c. 42, s. 2. This statute provided for an annual subsidy of $100,000 to the Island, of which one half was attributable to the failure to provide efficient ferry service in accordance with the Terms of Union.

65. See *Report of the Commission of Inquiry into Newfoundland Transportation*, Vol. 1 (Sullivan Commission) (St. John's, 1978), pp. 30–31.

66. The Sullivan Commission stated that the railway had been a drain on the Newfoundland treasury of approximately $750,000 annually ever since 1923.

67. Documents on Relations Between Canada and Newfoundland, no. 805.

68. Sullivan Commission Report, p. 34.

69. See *Re Residential Tenancies Act, 1979* [1981] 1 S.C.R. 714, pp. 721–23.

70. See *Reference Re Section 94(2) of the Motor Vehicle Act (B.C.)* [1985] 2 S.C.R. 486 [holding that the intentions of the drafters of the Charter of Rights, as manifested by statements made before a Parliamentary Committee, were entitled to minimal weight in judicial interpretation.]

71. Order in Council P.C. 1454, April 1, 1949.

72. Term 32(1): "Canada will maintain in accordance with the traffic offering a freight and passenger steamship service between North Sydney and Port aux Basques, which on completion of a motor highway between Corner Brook and Port aux Basques, will include suitable provision for the carriage of motor vehicles."

73. See Sullivan Commission Report, p. 34.

74. See *Attorney General of Newfoundland v. C.N.R.*, (1951) 67 C.R.T.C., p. 353.

75. See *The Queen (P.E.I) v. The Queen (Can)* [1976] 2 F.C. 712 affd. [1978] 1 F.C. 533.

76. For a description of these impacts, see the judgement of the trial division of the Federal Court: [1976] 2 F.C. 712, p. 728.

77. [1976] 2 F.C. 712, p. 729. The trial judge also held that the federal government's obligation included provision for the conveyance of automobiles as well as passengers. The 1873 Terms of Union did not refer to automobiles, since they were non-existent at the time. But Cattanach J. applied section 10 of the *Interpretation Act*, R.S.C. 1970, c. I-23 to hold that the only sensible modern interpretation of the Terms of Union was one that included automobiles.

78. See [1976] 2 F.C. 712, p. 737.

79. Ibid., p. 734.

80. [1978] 1 F.C. 533, p. 556. In the end, Jackett C.J. concluded that the Court could only issue a declaration that Prince Edward Island had a right to money compensation, as opposed to a judgement ordering the payment. But there was no practical difference between the issuance of a declaration as opposed to an actual judgement since in both cases the federal government would comply with the finding of the Court.

81. While Chief Justice Jackett did not express any final opinion on the point, he indicated that it was probably not open to individuals to seek compensation for the loss of ferry service. He held that the obligation was owed to the "Province," which he defined as "the mass of inhabitants of the geographical area whoever they may be from time to time." He indicated that this obligation to the Province did not give rise to rights in individuals or in groups of individuals. See ibid., pp. 555–56 and footnote 30.

82. Le Dain J. made the point that the provincial claim should be limited to damages or costs imposed on the government directly. The province should not be permitted to obtain a judgement for the adverse effects which the province as a whole might have suffered. See ibid., p. 589.

83. For a complete listing of the relevant statutes and orders, see "Schedule I" to the *Constitution Act, 1982*.

84. This follows from the holding in *Canada v. P.E.I.*

85. *Minister of Justice of Canada v. Borowski* (1981) 130 D.L.R. (3d) 588, p. 589 per Martland J. (S.C.C.).

86. [1976] 2 F.C. 712, p. 731 (per Cattanach J.).

87. See Order no. 1989-R-180.

88. See *P.E.I. v. CNR* [1991] 1 F.C., p. 129.

89. Iacobucci J.'s conclusion was as follows:

> It is clear that Canada was to obtain property in the railway presumably because of Canada's assumption of the debts and liabilities of Prince Edward Island at the time of Union. Once it obtained the property, it was legally free to do what it wished with the railway as owner thereof. If an obligation to operate perpetually were intended, clear language to that effect would have been employed as was done, as Counsel for CN pointed out, in the 1883 B.C. railway settlement.

90. In *P.E.I. v. CNR*, Justice Iacobucci also makes the point that the obligation to maintain a ferry service only extends to passengers and mails, but not freight. This is the same approach adopted by Ledain J. in the Federal Court of Appeal in *Canada v. P.E.I.* On the other hand, Chief Justice Jackett in the *Canada v. P.E.I.* case was of the view that automobiles *were included* within the constitutional obligation. This point does not seem of much practical significance, since the vessels providing the service all are equipped to transport automobiles and freight.

91. See generally the discussion of these developments in the decision of the Railway Transport Committee of the Canadian Transport Commission permitting the substitution of bus service for passenger trains: Pamphlet No. 14, 58 R.T.C., p. 359, July 3, 1968.

92. See opinion of D.H. Jones, Chairman, ibid., p. 371.

93. Ibid., p. 376.

94. See *Canadian National Railway Co. v. Board of Commissioners of Public Utilities* [1976] 2 S.C.R. 112.

95. See *Report of the Commission of Inquiry into Newfoundland Transportation*, Vol. 1 (1978), p. 233–34.

96. See "Remarks by the Honourable John Crosbie on the Newfoundland Transportation Initiative," June 20, 1988, p. 4. (Mimeographed.)

97. See "Memorandum of Understanding between the Government of Canada and the Government of the Province of Newfoundland," (MOU), June 20, 1988, paragraph 5. (Mimeographed.)

98. See *In the Matter of a complaint made by Atlantic Container Express Inc.* (National Transportation Agency of Canada, Decision No. 266-R-1991) May 22, 1991.

99. See *A.G. Nova Scotia v. A.G. Canada* (Nova Scotia Interdelegation) [1951] S.C.R. 31.

100. See *Reference Re. Canada Assistance Plan Act*, (S.C.C., August 15, 1991, unreported).

101. "Statement by the Honourable A. Brian Peckford, Premier of Newfoundland and Labrador on the Newfoundland Transportation Initiative," June 20, 1988, p. 7. (Mimeographed.) Obviously such a statement cannot itself alter any existing constitutional obligation. It does, however, give an indication of the legal opinion of the Government of the day with respect to the extent of the constitutional obligation.

102. All three members of the Agency were in agreement on this point; there was a dissenting opinion from one member of the board on the method to be used to calculate a Terms of Union rate. See *Atlantic Container Express Inc.*

103. Ibid., p. 4.

104. See the attempt by the National Transportation Agency in its recent decision on the complaint by Atlantic Container Express to deal with this and other problems in establishing a Terms of Union rate.

105. In fact, as noted earlier, article 11 of the Terms of Union did not even mention the line on Vancouver Island; the obligation was to build a railway to the "Seaboard" of British Columbia.

106. 42 B.C.L.R. 339, p. 359 (1989).

107. Ibid., p. 362.

108. The operators of the CPR promised to "thereafter and forever efficiently maintain, work and run the Canadian Pacific Railway." See S.C. 1881, c.1, section 7.

109. See Nova Scotia Interdelegation case, MOU between the Government of Canada and the Government of Newfoundland and Labrador.

110. As defined by section 52 of the *Constitution Act, 1982.*

111. See *Attorney General of British Columbia v. Attorney General of Canada* (Reasons for Judgment, B.C. Court of Appeal, October 4th, 1991, unreported).

112. Mr. Justice Esson, at trial, had found that the obligation to maintain service on the E. and N. was "perpetual"; this part of his Order was varied by the Court of Appeal.

113. See Reasons for Judgement, p. 41.

114. See, in particular, the Court's reasoning on pp. 44–45.

115. It is interesting to note that the Court of Appeal finds that the obligation is owed to the provincial government only. The implication is that private citizens are not entitled to rely upon these particular constitutional obligations. As noted previously, the obligations in Term 11 are part of the "Constitution of Canada" and are part of the "supreme law of Canada." It thus seems difficult to understand why the obligation can only be enforced by governments as opposed to private citizens. The Court of Appeal does not discuss the issue but merely notes in passing that the obligation could be varied with the consent of the B. C. government.

116. See Reasons for Judgement, p. 43.

117. See Reasons for Judgement, p. 45.

118. The "Canadian Pacific Railway" is defined in an 1874 statute as including the main line of railway, running from "a point near to and south of Lake Nipissing" westward to "some point in British Columbia on the Pacific Ocean." Further, the railway is to include two branch lines, the first constructed in Ontario, the second in Manitoba. See *An Act to Provide for the construction of the Canadian Pacific Railway*, S.C. 1874, ss. 2 and 3.

119. It is not known at this time whether the Attorney General of Canada intends to appeal. Leave to appeal would have to be granted by the Supreme Court of Canada.

120. See "Subsidy Agreement between the Government of Canada and the Government of the Province of British Columbia," April 18, 1977.

121. This is subject only to the single exception noted in paragraph (i) below.

122. All of the constitutional provisions identified here could be amended under section 43 of the *Constitution Act, 1982*, which requires the consent of the Parliament of Canada as well as any province to which the provision applies.

123. See *Reference Re Canada Assistance Plan Act*, (S.C.C. August 15, 1991, unreported).

124. The problem is potential only since there is no indication at this time of any dissatisfaction on the part of provinces with the enforceability of agreements relating to transportation.

125. Under the proposed section 95A, once an agreement had been ratified by the province and by the Parliament of Canada, it would have the force of law and it could not be amended without the consent of both parties. A similar procedure is contemplated by the recent constitutional proposals published by the Government of Canada on September 24, 1991. See *Shaping Canada's Future Together: Proposals*, (Ottawa: Supply and Services Canada, 1991), p. 34.

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# Volume

# 4

# DIRECTIONS

THE FINAL
REPORT OF
THE ROYAL
COMMISSION
ON NATIONAL
PASSENGER
TRANSPORTATION

Volume 4

The opinions expressed in Volumes 3 and 4 are those of the authors of the individual studies and do not necessarily reflect the views of the Royal Commission.

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# PREFACE

Volumes 3 and 4 present a selection of research studies prepared for the Royal Commission by its Research Division staff and by various authors under contract. Volume 3 includes: historical overviews and general surveys related to transportation objectives; studies on subsidies, pricing and competition; and a discussion of institutional issues. Volume 4 includes: applied analyses related to determining the cost of transportation; industry studies of the air, bus and rail modes; and studies on travel demand, taxation and technology.

The historical overviews comprise two studies. The first, by D.R. Owram, entitled "Icons and Albatrosses: Passenger Transportation as Policy and Symbol in Canada," examines the evolution of transportation in Canada, with particular emphasis on rail and roads. The second, by George W. Wilson, entitled "U.S. Intercity Passenger Transportation Policy, 1930–1991: An Interpretive Essay," provides a survey and a critique of U.S. transportation policy over the last 60 years.

Two of the general surveys, namely, that by Robin Boadway, entitled "The Role of Equity Considerations in the Provision and Pricing of Passenger Transportation Services," and that by David W. Slater, entitled "Transportation and Economic Development: A Survey of the Literature," discuss issues related to the inclusion of equity or economic development as objectives for a passenger transportation system.

The studies that discuss subsidies, pricing and competition issues include those by Trevor D. Heaver, entitled "Subsidies in Canadian Passenger Transportation"; David Gillen and Tae Hoon Oum, entitled "Transportation Infrastructure Policy: Pricing, Investment and Cost Recovery"; John Blakney, entitled "Competition Policy and Canadian Passenger Transportation"; and Keith Acheson and Don McFetridge, entitled "Controlling Market Power in Weakly Contestable Canadian Airline Markets." Federal-provincial institutional issues are discussed in two papers by Patrick J. Monahan, entitled "Constitutional Jurisdiction Over Transportation: Recent Developments and Proposals for Change" and "Transportation Obligations and the Canadian Constitution."

The applied analyses in Volume 4 include three studies on the cost of transportation. These are "Transportation Infrastructure Costs in Canada" by Ashish Lall; "Road Costs" by Fred P. Nix, Michel Boucher and Bruce Hutchinson; and "Environmental Damage from Transportation" by VHB Research & Consulting Inc. Of the industry studies, that by Steven A. Morrison, entitled "Deregulation and Competition in the Canadian Airline Industry," and that by Ron Hirshhorn, entitled "The Effects of U.S. Airline Deregulation: A Review of the Literature," relate to the air mode. The bus mode is addressed in "An Analysis of the Canadian Intercity Scheduled Bus Industry" by Richard Lake, L. Ross Jacobs and S. T. Byerley. The rail mode is addressed in the study by Charles Schwier and Richard Lake, entitled "VIA Rail Services: Economic Analysis," while airports are considered in "Airport Investment and Pricing Policies" by A. Cubukgil, S. Borins and M. Hoen.

Volume 4 concludes with studies on three further topics. Travel demand is addressed in two studies. The paper by Eric J. Miller and Kai-Sheng Fan, entitled "Travel Demand Behaviour: Survey of Intercity Mode-Split Models in Canada and Elsewhere," is a general survey of demand modelling. It is complemented by Richard Laferrière's study, entitled "Price Elasticities of Intercity Passenger Travel Demand," which calculates various elasticities of travel demand from several models on comparable bases. The impact of taxes on the cost competitiveness of Canadian intercity passenger transportation carriers, both intermodally and with U.S. carriers, is addressed in "Differential Taxation of Canadian and U.S. Passenger Transportation" by Ken McKenzie, Jack Mintz and Kim Scharf. Finally, a discussion of general technology issues and of prospective technology relevant to Canadian intercity passenger transportation modes over the next 25 years is provided in "Notes on Intercity Passenger Transportation Technology" by Richard Lake.

The contribution of those who participated in the editing and translation of all of the four volumes of this report was acknowledged at the beginning of Volume 1. In addition, the Royal Commission staff was ably assisted in the editing of Volumes 3 and 4 by PMF Editorial Services Inc.

# 11

# TRANSPORTATION INFRASTRUCTURE COSTS IN CANADA

Ashish Lall*
September 1990

## I. INTRODUCTION

In the mid-1970s, various studies produced by the Research Branch of the Canadian Transport Commission (CTC) examined the costs and revenues of road, rail, air and marine modes of transportation.

These studies covered the period 1955 to 1968. The capital stock estimates in the various studies were based on historical investment series which went as far back as the late 19th century. An attempt was made to incorporate not only the direct costs and revenues relevant to the various modes, but also to account for the costs of licensing, economic regulation and justice.

In 1982, Transport Canada produced a study that extended the work of the CTC studies to cover the period 1969 to 1979. Although the general methodology was similar to that of the CTC studies, careful examination shows that some data and/or methodology changes have been made.

The Transport Canada study derived a measure of cost recovery for each mode and therefore was able to cast light on the contribution to each mode from the public purse. The scope of the study was restricted to infrastructure provided by the government. In the case of the air mode, for example, the costs and revenues were related to civil aviation services and did not include carrier information. The rail mode was the only exception: both infrastructure costs, which are borne by the carrier, and operating costs were included.

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* Research Division, Royal Commission on National Passenger Transportation.

The Transport Canada study examined costs on the basis of cash flow, book value and inflation adjustments. The cash flow analysis treated all costs as current costs. The book-value method classified operating and maintenance (O&M) costs as current costs, and capital costs were allocated over the service life of the assets. The book-value analysis derived gross and net capital stocks for the different modes based on investment at historical nominal cost. These historical cost measures were adjusted for inflation in the inflation-adjusted analysis.

The following three sections on road costs, civil aviation costs, and rail costs and revenues attempt to update the Transport Canada study. They, however, do not include any indirect costs such as those of regulation and justice, nor do they attempt to include revenues (with the exception of rail).

The Transport Canada study and its predecessors were based on detailed information collected from a variety of sources. The following sections rely primarily on Statistics Canada data. Some information is also derived from the tables in the CTC and Transport Canada studies. Any inconsistencies between the two sources affect the current study. This leads to inherent biases in the capital stock estimates that can only be rectified by collecting historical data on investment expenditure.

Tables 1 and 2 present some comparative results for the three modes under consideration. The constant-dollar, cash-flow analysis shows a decline in O&M costs for all three modes. Real total costs have also declined for the rail mode. Over the period 1983 to 1986, the real net capital stock of the air and rail modes has increased at an annual rate of 9.46 percent and 6.22 percent respectively. Although the real net capital stock of the road mode registers a decline, this does not suggest that road infrastructure is deteriorating in Canada; the growth rate of the net stock of roads is quite sensitive to the method of depreciation, and pavement life.

*Table 1*

*MODAL COSTS IN MILLIONS OF 1986 $*

| | Cash flow (current $) | | Cash flow (1979 $) | | Book value (current $) | | Inflation adj. (1979 $) | | Inflation adj. (current $) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | O&M | TC | O&M | TC | NCS | TC | NCS | TC | NCS | TC |
| Air | 949 | 1,374 | 627 | 978 | 2,087 | 1,358 | 2,017 | 951 | 2,435 | 1,340 |
| Rail | 6,106 | 7,286 | 4,030 | 4,829 | 10,559 | 7,805 | 9,348 | 5,067 | 13,733 | 7,634 |
| Road | 2,848 | 7,856 | 1,881 | 5,136 | 34,099 | 9,088 | 33,360 | 6,868 | 51,348 | 10,525 |

*Table 2*

*ANNUAL AVERAGE COMPOUND GROWTH RATES (%), 1983–1986*

| | Cash flow (current $) | | Cash flow (1979 $) | | Book value (current $) | | Inflation adj. (1979 $) | | Inflation adj. (current $) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | O&M | TC | O&M | TC | NCS | TC | NCS | TC | NCS | TC |
| Air | -0.54 | 3.96 | -3.21 | 2.98 | 16.80 | 3.34 | 9.46 | 0.32 | 8.42 | 1.58 |
| Rail | 1.14 | 0.84 | -1.54 | -1.77 | 9.50 | 2.52 | 6.22 | -0.12 | 8.19 | 2.41 |
| Road | -0.64 | 4.06 | -3.30 | 1.83 | 6.73 | 3.72 | -0.10 | -0.74 | 1.72 | 1.34 |

**Notes:** **O&M — Operating and maintenance expenditure**
**TC — Total cost**
**NCS — Net capital stock**

**The Estimates version of the air data is reported here.**
**Road data are for the case of 20-year, straight line depreciation.**

**As noted in the text, air and road estimates are for infrastructure costs/capital whereas rail estimates are for total costs/capital.**

# II. ROAD COSTS IN CANADA, 1980–1988

## BACKGROUND AND PURPOSE

One of the most widely quoted studies of road costs and revenues is by Haritos.[1] This study covered the period 1955 to 1968. It was updated by Transport Canada in the form of a multimodal study in 1982,[2] to cover the period 1969 to 1979. The Transport Canada study (henceforth referred to as the TC study) attempted to derive a cost-recovery index on an industry-wide basis for the rail, road, marine and air modes of transport.

Haritos included those infrastructure costs and revenues that are attributable to users of each mode. The costs included the following categories:

- infrastructure costs;
- administration, O&M costs;
- costs of safety including regulation, courts, police, search and rescue;
- costs of economic regulation (CTC/National Transportation Agency [NTA] costs); and
- costs of licensing and registration, etc.

The purpose of this section is to update the road-cost estimates computed in the TC study. Unfortunately, the lack of data does not permit as detailed an analysis.

## DATA AND METHODOLOGY

Data on road expenditures by various levels of government are available from a variety of sources (see Appendix 1). None of the listed sources were used in this study, either because of inconsistencies in the data or because information was not available for the entire period being studied.

The data used here are from Statistics Canada,[3] and include capital and O&M expenditures on roads by all levels of government. Consolidated Government Expenditure on Roads is taken to represent the total expenditure on roads.[4] The total value of construction (new and repair) work purchased by all levels of government is taken to represent capital expenditure on roads. This includes expenditures on highways, roads, streets, bridges, trestles, culverts, overpasses and viaducts. O&M expenditures are then derived as a residual.

As is discussed later, the information utilized in this analysis contains some margin of error compared to other sources; in general, it overestimates road expenditures. It is assumed that costs of courts, police, etc., are included in the residual measure of O&M expenditures. For the purposes of this analysis, some adjustments are made to the data prior to use. Although some of these adjustments are no doubt arbitrary or naïve, the nature of the information restricts choice to that between equally arbitrary alternatives. The adjustments made to the data are described below.

Data on total expenditures on roads are available for the period 1978 to 1985. Information on total expenditures on transportation and communications is available for the period 1978 to 1988. It is assumed that the road expenditures' share of transportation and communications costs is constant over the period 1985 to 1988. The 1985 share (66.28 percent) is used to derive road expenditures for the period 1986 to 1988. O&M expenditures are derived by subtracting capital expenditures from total road expenditures.

Haritos classified road maintenance costs as those that are attributable to users and those that are attributable to non-users. He determined that 92 percent of maintenance costs are attributable to users. Non-users bear some of the snow ploughing and other road costs.[5] Following this procedure, the O&M expenditures derived residually are reduced by 8 percent. These adjusted O&M expenditures are added to capital expenditures to derive the adjusted total expenditures on roads.[6]

The TC study divided capital expenditures into those associated with land or right-of-way, and other capital expenditures. Calculations from the TC study showed that, over the period 1970 to 1979, the share of expenditures on land accounted for an average of 3.76 percent of total capital expenditures. It is assumed that this share prevails over the period 1980 to 1988. In this manner, capital expenditures are divided between land costs and other.

The TC study covered the period 1969 to 1979. Data obtained for this study commenced in 1978. The information for the two overlapping years is not included here; however, it can be used to check the integrity of the information used here. Some data on total expenditures on roads are also available in a paper by Hicks.[7] These are also utilized for checking purposes. Column 2 of Table 3 presents the data utilized in this analysis; column 3 is taken from the paper by Hicks; and column 4 shows the ratio of column 2 to column 3.

Table 4 shows a comparison of the data used here with that used in the TC study.[8] If the information used by Hicks and Transport Canada is "the truth," then the data utilized in this analysis are within 10 percent of "the truth."

### Table 3
### TOTAL EXPENDITURES ON ROADS
### (THOUSANDS OF CURRENT $)

| Year | RCNPT | Hicks | RCNPT/Hicks |
|---|---|---|---|
| 1978 | 4,953,486 | 4,705,301 | 1.05 |
| 1979 | 5,312,560 | 5,043,199 | 1.05 |
| 1980 | 5,982,627 | 5,673,594 | 1.05 |
| 1981 | 6,658,200 | 6,229,165 | 1.07 |
| 1982 | 7,356,303 | 6,670,693 | 1.10 |
| 1983 | 6,955,382 | 6,650,257 | 1.05 |
| 1984 | 7,283,913 | 7,061,900 | 1.03 |

### Table 4
### ROAD EXPENDITURES
### (THOUSANDS OF CURRENT $)

| Capital Expenditures on Roads | | | |
|---|---|---|---|
| **Year** | **RCNPT** | **TC Study** | **RCNPT/TC Study** |
| 1978 | 2,833,759 | 3,178,000 | 0.89 |
| 1979 | 3,170,272 | 3,222,000 | 0.98 |
| **Road Operating and Maintenance Expenditures** | | | |
| **Year** | **RCNPT** | **TC Study** | **RCNPT/TC Study** |
| 1978 | 2,119,727 | 1,974,000 | 1.07 |
| 1979 | 2,142,288 | 2,004,000 | 1.07 |
| **Total Expenditures on Roads** | | | |
| **Year** | **RCNPT** | **TC Study** | **RCNPT/TC Study** |
| 1978 | 4,953,486 | 5,152,000 | 0.96 |
| 1979 | 5,312,560 | 5,226,000 | 1.02 |

The calculation of depreciation for the years 1980 to 1988 requires knowledge of past nominal investments. Haritos used the straight line method of depreciation and assumed a road life of 20 years. This implies that the calculation of depreciation expenses in 1980 will require knowledge of the depreciation expenses from 1961 to 1980. For the period 1961 to 1968, real investment is derived from gross capital stocks.[9] This is converted to a nominal series using the Highway Construction Price Index.[10]

A nominal investment series for the period 1970 to 1979 is derived from the gross capital stocks reported in the TC study.[11] For the year 1969, total investment is available; this, however, has to be broken down to exclude land. This is accomplished by applying the share of land in 1970 to total investment in 1969.[12] Depreciation expenses carried forward from the past can then be derived from the nominal investment series for the period 1961 to 1979 by using a 20-year road life. In the inflation-adjusted analysis, this exercise is conducted at 1979 prices.

The cash-flow analysis treats all costs as current costs and, in this case, total costs are merely the sum of capital and O&M costs. The book-value analysis forms gross capital stocks of land and other capital. This is nothing but the cumulative nominal investment in each type of capital. Following Haritos, roads are assumed to have a useful life of 20 years, and the straight line method of depreciation is used.[13] Land is not depreciated. Subtracting the accumulated depreciation in any year from the gross capital stock in that year yields the net stock or the book value of the assets. Following Haritos, the cost of capital is obtained by multiplying the net stock by the prime lending rate.[14] Total cost is the sum of O&M expenditures, depreciation and the cost of capital.

The inflation-adjusted analysis follows the same method as the book-value analysis. The difference lies in the fact that all expenditures are deflated to remove the effects of inflation.[15] The expenditures on land and O&M are deflated using the implicit Gross Domestic Product (GDP) deflator.[16] Other capital expenditures are deflated using the Highway Construction Price Index.[17] Following the TC study, a six percent cost of capital is used in the inflation-adjusted analysis.

The inflation-adjusted analysis is also presented in "current" terms. This amounts to a revaluation of the constant dollar magnitudes in current-year dollars. The gross and net capital stocks, the stock of land, and depreciation expenses derived in the inflation-adjusted analysis (at 1979 prices) are inflated to current-year dollars using the price deflators described above. The cost of capital is assumed to be 6 percent of the inflated net stock. Total annual costs are derived as the sum of depreciation, the cost of capital and O&M expenditures.

## RESULTS

The results are presented in the tables below. Table 5A presents the cash-flow analysis in current and 1979 dollars. The book-value analysis is presented in Table 5B. Table 5C presents the inflation-adjusted analysis in 1979 dollars. These results are then inflated and presented in Table 5D.

The real annual total costs of road infrastructure (1979 dollars) in 1988 were about $166 million lower compared to 1980. Though the stock of right-of-way or land has been increasing, the real book-value of other capital in 1988 was approximately $15 million lower than that in 1980. In real terms, there was a deterioration in road infrastructure in Canada over the period 1980 to 1988.

*Table 5A*
*ROAD INFRASTRUCTURE: CASH-FLOW ANALYSIS*

| | Annual Expenditures | | | | | |
|---|---|---|---|---|---|---|
| | Millions of current $ | | | Millions of 1979 constant $ | | |
| Year | O&M | Capital | Total | O&M | Capital | Total |
| 1980 | 2,521 | 3,462 | 5,983 | 2,280 | 3,062 | 5,342 |
| 1981 | 2,891 | 3,767 | 6,658 | 2,359 | 2,817 | 5,176 |
| 1982 | 3,238 | 4,118 | 7,356 | 2,431 | 2,937 | 5,368 |
| 1983 | 2,904 | 4,052 | 6,955 | 2,077 | 2,785 | 4,861 |
| 1984 | 3,238 | 4,046 | 7,284 | 2,245 | 2,669 | 4,914 |
| 1985 | 2,990 | 5,097 | 8,086 | 2,021 | 3,230 | 5,251 |
| 1986 | 2,848 | 5,008 | 7,856 | 1,881 | 3,256 | 5,136 |
| 1987 | 2,931 | 5,126 | 8,057 | 1,853 | 3,428 | 5,280 |
| 1988 | 3,048 | 5,362 | 8,410 | 1,852 | 3,496 | 5,348 |

### Table 5B

## ROAD INFRASTRUCTURE: BOOK-VALUE ANALYSIS

### (MILLIONS OF CURRENT $)

| Year | Capital stock | | | Annual costs | | | |
|---|---|---|---|---|---|---|---|
| | Gross | Net | Land | O&M | Depre-ciation | Cost of capital | Total costs |
| 1980 | 39,627 | 22,209 | 1,873 | 2,521 | 1,620 | 3,165 | 7,305 |
| 1981 | 43,252 | 24,058 | 2,015 | 2,891 | 1,777 | 4,641 | 9,309 |
| 1982 | 47,216 | 26,074 | 2,170 | 3,238 | 1,948 | 4,122 | 9,308 |
| 1983 | 51,115 | 27,862 | 2,322 | 2,904 | 2,111 | 3,112 | 8,127 |
| 1984 | 55,009 | 29,489 | 2,474 | 3,238 | 2,267 | 3,556 | 9,061 |
| 1985 | 59,914 | 31,931 | 2,666 | 2,990 | 2,463 | 3,378 | 8,831 |
| 1986 | 64,734 | 34,099 | 2,854 | 2,848 | 2,652 | 3,587 | 9,088 |
| 1987 | 69,667 | 36,182 | 3,047 | 2,931 | 2,850 | 3,445 | 9,226 |
| 1988 | 74,827 | 38,277 | 3,248 | 3,048 | 3,065 | 4,145 | 10,258 |

### Table 5C

## ROAD INFRASTRUCTURE: INFLATION-ADJUSTED ANALYSIS

### (MILLIONS OF 1979 CONSTANT $)

| Year | Capital stock | | | Annual costs | | | |
|---|---|---|---|---|---|---|---|
| | Gross | Net | Land | O&M | Depre-ciation | Cost of capital | Total costs |
| 1980 | 90,414 | 33,962 | 4,720 | 2,280 | 2,808 | 2,038 | 7,126 |
| 1981 | 93,115 | 33,806 | 4,835 | 2,359 | 2,857 | 2,028 | 7,244 |
| 1982 | 95,936 | 33,722 | 4,952 | 2,431 | 2,905 | 2,023 | 7,359 |
| 1983 | 98,612 | 33,461 | 5,060 | 2,077 | 2,937 | 2,008 | 7,021 |
| 1984 | 101,175 | 33,078 | 5,166 | 2,245 | 2,946 | 1,985 | 7,176 |
| 1985 | 104,276 | 33,214 | 5,295 | 2,021 | 2,964 | 1,993 | 6,978 |
| 1986 | 107,407 | 33,360 | 5,420 | 1,881 | 2,986 | 2,002 | 6,868 |
| 1987 | 110,713 | 33,646 | 5,542 | 1,853 | 3,020 | 2,019 | 6,892 |
| 1988 | 114,086 | 33,947 | 5,664 | 1,852 | 3,072 | 2,037 | 6,960 |

*Table 5D*

### ROAD INFRASTUCTURE: INFLATION-ADJUSTED ANALYSIS (MILLIONS OF CURRENT $)

| Year | Capital stock | | | Annual costs | | | |
|---|---|---|---|---|---|---|---|
| | **Gross** | **Net** | **Land** | **O&M** | **Depre-ciation** | **Cost of capital** | **Total costs** |
| 1980 | 102,329 | 38,437 | 5,217 | 2,521 | 3,178 | 2,306 | 8,005 |
| 1981 | 124,956 | 45,366 | 5,926 | 2,891 | 3,834 | 2,722 | 9,447 |
| 1982 | 134,792 | 47,381 | 6,596 | 3,238 | 4,082 | 2,843 | 10,162 |
| 1983 | 143,713 | 48,764 | 7,076 | 2,904 | 4,281 | 2,926 | 10,110 |
| 1984 | 153,694 | 50,248 | 7,451 | 3,238 | 4,475 | 3,015 | 10.728 |
| 1985 | 164,980 | 52,550 | 7,833 | 2,990 | 4,690 | 3,153 | 10,832 |
| 1986 | 165,322 | 51,348 | 8,209 | 2,848 | 4,595 | 3,081 | 10,525 |
| 1987 | 165,210 | 50,207 | 8,767 | 2,931 | 4,507 | 3,012 | 10,450 |
| 1988 | 174,531 | 51,933 | 9,322 | 3,048 | 4,699 | 3,116 | 10,863 |

The following addendum to this analysis examines the effects of changes in pavement life on capital stock and road costs. The issue of the appropriate rate of depreciation is particularly contentious in the case of roads and highways. This is because decay depends not only on the initial thickness of the road and on the amount and type of vehicular traffic, but also on climatic conditions.

## ADDENDUM: SENSITIVITY OF ROAD COSTS TO PAVEMENT LIFE

### Methodology and Results

This addendum includes an examination of the impact on road costs of a change in the rate and method of depreciation. Tables 5A through 5D used the 1979 capital stock benchmarks from the TC study. Roads were assumed to have a life of 20 years and the straight line method of depreciation was used. In this addendum, the following version of the perpetual inventory method[18] is used to construct capital stocks for the period 1956 to 1988:

$$K_{it} = I_{it} + (1 - \delta_i)K_{it-1}$$

where $I_{it}$ is nominal investment in year $t$ for capital category $i$; $K_{it}$ is the capital stock in year $t$ for capital category $i$; and $\delta_i$ is the depreciation rate for capital category $i$. The depreciation expense in year $t$ is then $K_{it-1}*\delta_i$. The derivation of the investment series and investment in land was discussed earlier.[19] The 1955 benchmark capital stock reported in the work by Haritos[20] is used. The capital stocks are first constructed at 1968 prices and later converted to 1979 prices.

Net capital stocks are constructed for varying road lives. These are 20 years, 25 years, 27 years, 30 years, 33.3 years and 45 years.[21] A life of approximately 12.4 years (depreciation rate 8.0679 percent) is also used. The present discounted value[22] (PDV) of the depreciation stream generated by a dollar's worth of investment depreciated (exponential decay) at this rate is identical to the PDV of the depreciation stream generated by a dollar's worth of investment, assuming a life of 20 years, using the straight line method of depreciation.

The results of the inflation-adjusted analysis[23] are reported in Tables S-1 to S-6. Table S-1 shows that unlike total cost, the net capital stock is quite sensitive to both the rate and method of depreciation. All results reported under the column heading of (SL 20) are reproduced from Table 5C in the main text. Table S-2 shows that the real total cost of road infrastructure has increased by approximately $250 million over the period 1980 to 1988. The net capital stock no longer shows the deterioration encountered earlier.

One should not expect any changes in the gross capital stock and the stock of land. Unfortunately, changes do occur because investment data are derived from tables of two different studies. It is clear that there have been some changes in methodology between the work of Haritos and the TC study.[24] Unless pre-1955 data are collected, such biases cannot be removed. Another source of bias in these results is the use of the 1955 benchmark. Prior to 1955, the straight line method of depreciation was used by Haritos, and the road life was assumed to be 20 years. The sensitivity exercise changes these assumptions in 1956.

Clearly, the results of this study, due to their dependence on earlier work, are constrained by the assumptions of that work. The availability of a consistent historical investment series would help produce a clearer picture of the stock of road infrastructure in Canada.

### Table S-1

### 1988 Ratios with Respect to the Base Case of 20 Years

| | (SL 20) | (12.4) | (25) | (27) | (30) | (33.3) | (45) |
|---|---|---|---|---|---|---|---|
| Ratio of road life | * | 0.62 | 1.25 | 1.35 | 1.50 | 1.67 | 2.25 |
| Ratio of net capital stock | 0.72 | 0.73 | 1.13 | 1.17 | 1.22 | 1.28 | 1.41 |
| Ratio of depreciation expenditure | 1.33 | 1.18 | 0.90 | 0.86 | 0.81 | 0.76 | 0.62 |
| Ratio of cost of capital | 0.72 | 0.73 | 1.13 | 1.17 | 1.22 | 1.28 | 1.41 |
| Ratio of total cost | 0.99 | 0.95 | 1.02 | 1.02 | 1.03 | 1.03 | 1.04 |

**Note:** *** not comparable**

### Table S-2

### Road Infrastucture: Inflation-Adjusted Analysis (20-Year Life)
### Method of Depreciation: Exponential Decay
### (millions of 1979 constant $)

| Year | Capital stock | | | Annual costs | | | |
|---|---|---|---|---|---|---|---|
| | Gross | Net | Land | O&M | Depre-ciation | Cost of capital | Total costs |
| 1980 | 73,296 | 41,028 | 3,410 | 2,280 | 2,004 | 2,462 | 6,746 |
| 1981 | 75,997 | 41,678 | 3,525 | 2,359 | 2,051 | 2,501 | 6,911 |
| 1982 | 78,818 | 42,415 | 3,642 | 2,431 | 2,084 | 2,545 | 7,059 |
| 1983 | 81,494 | 42,970 | 3,751 | 2,077 | 2,121 | 2,578 | 6,776 |
| 1984 | 84,057 | 43,385 | 3,856 | 2,245 | 2,149 | 2,603 | 6,997 |
| 1985 | 87,157 | 44,316 | 3,986 | 2,021 | 2,169 | 2,659 | 6,849 |
| 1986 | 90,289 | 45,231 | 4,110 | 1,881 | 2,216 | 2,714 | 6,810 |
| 1987 | 93,595 | 46,276 | 4,232 | 1,853 | 2,262 | 2,777 | 6,891 |
| 1988 | 96,968 | 47,335 | 4,354 | 1,852 | 2,314 | 2,840 | 7,006 |

### Table S-3

## Road Infrastucture: Inflation-Adjusted Analysis

### (Millions of 1979 constant $)

| Year | Net Capital Stock for Varying Asset Lives | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(SL 20)** | **(12.4)** | **(20)** | **(25)** | **(27)** | **(30)** | **(33.3)** | **(45)** |
| 1980 | 33,962 | 31,639 | 41,028 | 45,029 | 46,326 | 48,027 | 49,636 | 53,709 |
| 1981 | 33,806 | 31,788 | 41,678 | 45,929 | 47,312 | 49,127 | 50,849 | 55,217 |
| 1982 | 33,722 | 32,044 | 42,415 | 46,913 | 48,381 | 50,311 | 52,144 | 56,811 |
| 1983 | 33,461 | 32,135 | 42,970 | 47,712 | 49,265 | 51,310 | 53,256 | 58,224 |
| 1984 | 33,078 | 32,105 | 43,385 | 48,367 | 50,003 | 52,162 | 54,221 | 59,494 |
| 1985 | 33,214 | 32,615 | 44,316 | 49,533 | 51,252 | 53,524 | 55,695 | 61,272 |
| 1986 | 33,360 | 33,115 | 45,231 | 50,683 | 52,485 | 54,871 | 57,155 | 63,041 |
| 1987 | 33,646 | 33,749 | 46,276 | 51,961 | 53,847 | 56,348 | 58,746 | 64,946 |
| 1988 | 33,947 | 34,400 | 47,335 | 53,256 | 55,226 | 57,843 | 60,357 | 66,876 |
| Growth rate(%): | -0.005 | 1.05 | 1.79 | 2.10 | 2.20 | 2.32 | 2.44 | 2.74 |

**Note:** **Growth rate is the average annual compound rate over the period 1980–1988.**

### Table S-4

## Road Infrastucture: Inflation-Adjusted Analysis

### (Millions of 1979 constant $)

| Year | Depreciation Expenditures for Varying Asset Lives | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **(SL 20)** | **(12.4)** | **(20)** | **(25)** | **(27)** | **(30)** | **(33.3)** | **(45)** |
| 1980 | 2,808 | 2,518 | 2,004 | 1,754 | 1,669 | 1,555 | 1,444 | 1,154 |
| 1981 | 2,857 | 2,553 | 2,051 | 1,801 | 1,716 | 1,601 | 1,489 | 1,194 |
| 1982 | 2,905 | 2,565 | 2,084 | 1,837 | 1,752 | 1,638 | 1,525 | 1,227 |
| 1983 | 2,937 | 2,585 | 2,121 | 1,877 | 1,792 | 1,677 | 1,564 | 1,262 |
| 1984 | 2,946 | 2,593 | 2,149 | 1,908 | 1,825 | 1,710 | 1,598 | 1,294 |
| 1985 | 2,964 | 2,590 | 2,169 | 1,935 | 1,852 | 1,739 | 1,627 | 1,322 |
| 1986 | 2,986 | 2,631 | 2,216 | 1,981 | 1,898 | 1,784 | 1,671 | 1,362 |
| 1987 | 3,020 | 2,672 | 2,262 | 2,027 | 1,944 | 1,829 | 1,715 | 1,401 |
| 1988 | 3,072 | 2,723 | 2,314 | 2,078 | 1,994 | 1,878 | 1,762 | 1,443 |

### Table S-5
### ROAD INFRASTUCTURE: INFLATION-ADJUSTED ANALYSIS
### (MILLIONS OF 1979 CONSTANT $)

| Year | Cost of Capital for Varying Asset Lives | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (SL 20) | (12.4) | (20) | (25) | (27) | (30) | (33.3) | (45) |
| 1980 | 2,038 | 1,898 | 2,462 | 2,702 | 2,780 | 2,882 | 2,978 | 3,223 |
| 1981 | 2,028 | 1,907 | 2,501 | 2,756 | 2,839 | 2,948 | 3,051 | 3,313 |
| 1982 | 2,023 | 1,923 | 2,545 | 2,815 | 2,903 | 3,019 | 3,129 | 3,409 |
| 1983 | 2,008 | 1,928 | 2,578 | 2,863 | 2,956 | 3,079 | 3,195 | 3,493 |
| 1984 | 1,985 | 1,926 | 2,603 | 2,902 | 3,000 | 3,130 | 3,253 | 3,570 |
| 1985 | 1,993 | 1,957 | 2,659 | 2,972 | 3,075 | 3,211 | 3,342 | 3,676 |
| 1986 | 2,002 | 1,987 | 2,714 | 3,041 | 3,149 | 3,292 | 3,429 | 3,782 |
| 1987 | 2,019 | 2,025 | 2,777 | 3,118 | 3,231 | 3,381 | 3,525 | 3,897 |
| 1988 | 2,037 | 2,064 | 2,840 | 3,195 | 3,314 | 3,471 | 3,621 | 4,013 |

### Table S-6
### ROAD INFRASTUCTURE: INFLATION-ADJUSTED ANALYSIS
### (MILLIONS OF 1979 CONSTANT $)

| Year | Total Cost for Varying Asset Lives | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (SL 20) | (12.4) | (20) | (25) | (27) | (30) | (33.3) | (45) |
| 1980 | 7,126 | 6,697 | 6,746 | 6,736 | 6,729 | 6,717 | 6,703 | 6,657 |
| 1981 | 7,244 | 6,819 | 6,911 | 6,916 | 6,914 | 6,908 | 6,899 | 6,866 |
| 1982 | 7,359 | 6,918 | 7,059 | 7,083 | 7,086 | 7,087 | 7,085 | 7,066 |
| 1983 | 7,021 | 6,590 | 6,776 | 6,816 | 6,824 | 6,832 | 6,836 | 6,832 |
| 1984 | 7,176 | 6,764 | 6,997 | 7,055 | 7,070 | 7,085 | 7,096 | 7,108 |
| 1985 | 6,978 | 6,568 | 6,849 | 6,928 | 6,948 | 6,971 | 6,989 | 7,020 |
| 1986 | 6,868 | 6,499 | 6,810 | 6,903 | 6,928 | 6,957 | 6,981 | 7,025 |
| 1987 | 6,892 | 6,549 | 6,891 | 6,998 | 7,027 | 7,063 | 7,092 | 7,150 |
| 1988 | 6,960 | 6,639 | 7,006 | 7,126 | 7,160 | 7,201 | 7,236 | 7,308 |

### Table S-7

### DATA TABLE

### (MILLIONS IN 1968 $)

| Year | Real Investment and Deflators | | | |
|---|---|---|---|---|
| | Land | Capital | Capital deflator | Land deflator |
| 1956 | 15 | 274 | 1.027 | 0.747 |
| 1957 | 21 | 336 | 0.954 | 0.763 |
| 1958 | 22 | 314 | 0.861 | 0.777 |
| 1959 | 24 | 405 | 0.863 | 0.793 |
| 1960 | 27 | 529 | 0.850 | 0.803 |
| 1961 | 33 | 633 | 0.767 | 0.803 |
| 1962 | 26 | 677 | 0.797 | 0.817 |
| 1963 | 27 | 742 | 0.851 | 0.833 |
| 1964 | 32 | 872 | 0.899 | 0.857 |
| 1965 | 34 | 1,000 | 0.979 | 0.883 |
| 1966 | 39 | 987 | 1.054 | 0.927 |
| 1967 | 43 | 955 | 1.014 | 0.967 |
| 1968 | 38 | 855 | 1.000 | 1.000 |
| 1969 | 42 | 1,029 | 1.046 | 1.047 |
| 1970 | 42 | 1,033 | 1.093 | 1.093 |
| 1971 | 49 | 1,241 | 1.179 | 1.130 |
| 1972 | 49 | 1,260 | 1.239 | 1.193 |
| 1973 | 52 | 1,283 | 1.395 | 1.297 |
| 1974 | 57 | 1,173 | 1.871 | 1.487 |
| 1975 | 56 | 1,140 | 2.093 | 1.633 |
| 1976 | 53 | 1,090 | 2.183 | 1.773 |
| 1977 | 55 | 1,128 | 2.337 | 1.887 |
| 1978 | 64 | 1,207 | 2.528 | 1.997 |
| 1979 | 56 | 1,132 | 2.738 | 2.197 |
| 1980 | 54 | 1,075 | 3.099 | 2.428 |
| 1981 | 53 | 987 | 3.675 | 2.692 |
| 1982 | 53 | 1,030 | 3.847 | 2.926 |
| 1983 | 50 | 977 | 3.991 | 3.072 |
| 1984 | 48 | 936 | 4.160 | 3.168 |
| 1985 | 59 | 1,132 | 4.332 | 3.249 |
| 1986 | 57 | 1,144 | 4.215 | 3.327 |
| 1987 | 55 | 1,207 | 4.086 | 3.475 |
| 1988 | 56 | 1,232 | 4.189 | 3.615 |

# III. RAIL COSTS AND REVENUES, 1982-1987

## BACKGROUND AND PURPOSE

The purpose of this section is to update the estimates of rail costs and revenues computed in the TC study. The TC study updated the Haritos study done at the CTC.[25] The methodology of these studies, as mentioned earlier, was to look at rail costs on a cash-flow, book-value and an inflation-adjusted basis.

Canadian railways are under a statutory obligation to submit annual reports to the National Transportation Agency (NTA), copies of which are also submitted to the Chief Statistician. The non-confidential information is published by Statistics Canada. The TC study, and that preceding it, relied on the annual reports for their data.

In 1981, changes in the Uniform Classification of Accounts caused data consistency problems for the early 1980s. Prior to 1982, Statistics Canada did not publish railway property accounts.[26] Along with the accounting changes, the data in this study, which are more aggregative in nature, may make it difficult to draw comparisons with earlier work. The basic methodology employed here, however, is taken from the TC study.

## DATA AND METHODOLOGY

Data on rail revenues and expenditures were obtained from Statistics Canada publications.[27] Revenues include all rail revenues except government payments. O&M expenditures are derived by deducting depreciation expenses and taxes other than income taxes from total rail expenses.[28] Investment expenditures are classified into those on Land, Way and Structure (W&S) and Machinery and Equipment (M&E). These were obtained from the property accounts.[29]

This information is sufficient to derive the results of the cash-flow analysis in current dollars. The cash-flow analysis treats all costs as current costs; therefore, total costs are merely the sum of taxes other than income tax, capital costs and O&M costs. A revenue-to-expense ratio is easily derived.

The constant dollar version of the cash-flow analysis requires adjustment for inflation. Government payments, revenues, taxes other than income tax, O&M expenditures and expenditures on land are deflated by using the implicit GDP deflator.[30] Expenditures on way and structures are deflated by the implicit price index for total railway construction. Expenditures on machinery and equipment are deflated by the price index for capital expenditure on machinery and equipment by the railway transport industry.[31]

The book-value analysis necessitates the construction of capital stock series. This requires an investment series, a capital stock benchmark and knowledge of the decay rate of the assets. The 1982 net book values of W&S capital and M&E capital are used as the respective capital stock benchmarks for that year.[32] The 1982 end-of-year balance of land is used as the benchmark capital stock for land.[33] The depreciation rates used are 3 percent (exponential decay) for W&S capital and 6 percent (exponential decay) for M&E capital.[34] To construct capital stocks for the period 1983 to 1987, the same version of the perpetual inventory method is used here as in the addendum to Section II:

$$K_{it} = I_{it} + (1 - \delta_i)K_{it-1}$$

where $I_{it}$ is nominal investment in year $t$ for capital category $i$; $K_{it}$ is the capital stock in year $t$ for capital category $i$; and $\delta_i$ is the depreciation rate for capital category $i$. The depreciation expense in year $t$ is $K_{it-1} * \delta_i$. Following the TC study, the cost of capital is obtained by multiplying the net capital stock by the prime lending rate.[35] Total cost is the sum of O&M expenditures, depreciation, the cost of capital and taxes.

The inflation-adjusted analysis follows the same method as the book-value analysis. The difference lies in the fact that all expenditures are deflated to remove the effects of inflation. The ratio of inflation-adjusted to book-value net capital stock is calculated from the TC study for the year 1979 for each type of capital.[36] The same ratio is assumed to prevail in the year 1982. This ratio is then applied to the 1982 benchmark capital stocks used in the book-value analysis to derive those for the inflation-adjusted analysis. Following the TC study, a 6 percent cost of capital is used in the inflation-adjusted analysis.

The inflation-adjusted analysis is also presented in "current" terms. This amounts to a revaluation of the constant dollar magnitudes in current-year dollars. The net capital stocks, depreciation expenses,[37] taxes, O&M expenses and revenues derived in the inflation-adjusted analysis (at 1982 prices) are inflated to current-year dollars, using the price deflators described above. The cost of capital is assumed to be 6 percent of the inflated net stock.

## RESULTS

The results are presented below in Tables 6 to 10. Each table presents results for VIA Rail, Class I railways (CN, CP and VIA), Class II/III railways and all Canadian railways (sum of Class I and Class II/III). Government payments, which comprise maritime freight, eastern grain and flour, branch-line, intercity passenger, commuter service and other payments, are not included in the calculation of the revenue-to-expense ratio.

Table 7 shows that in real terms there has been a decline of $315 million in government payments to Canadian railways as a whole; with CN and CP accounting for over $300 million. This sharp drop is almost entirely due to the drop in branch-line payments to the railways since 1984. In 1987, Class I railways were able to cover all their costs without relying on government payments. Compared to 1982, VIA's cost recovery is unchanged in 1987. Canadian railways as a whole, however, increased their revenue-to-expense ratio from 0.79 to 0.96. Not only have revenues increased over this six-year period by $577 million, but O&M expenditures have declined by about $350 million.

Table 9 shows that, in real terms, the net total capital stock of Canadian railways has increased by more than $2 billion over the period 1982 to 1987. Most of this increase is accounted for by way-and-structures capital. The M&E stock of VIA registers a decline of about $25 million. The revenue-to-expense ratio has increased from 0.85 in 1983 to 0.91 in 1987 for Canadian railways.

## *Table 6*

## *RAIL CASH-FLOW ANALYSIS (CURRENT $)*

### VIA RAIL: CASH-FLOW ANALYSIS

(MILLIONS OF CURRENT $)

| | **Annual Expenditures** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **O&M** | **Land** | **W&S** | **M&E** | **Taxes** | **Total expend-itures** | **Annual revenues** | **Revenue/ expense ratio** | **Gov't pay-ments** |
| 1982 | 576 | 0.362 | 2 | 12 | 3 | 593 | 157 | 0.27 | 449 |
| 1983 | 588 | 0.003 | 9 | 3 | 7 | 607 | 173 | 0.29 | 451 |
| 1984 | 543 | 0.000 | 4 | 3 | 3 | 552 | 175 | 0.32 | 398 |
| 1985 | 672 | 0.026 | 56 | 2 | 7 | 737 | 200 | 0.27 | 524 |
| 1986 | 624 | 0.080 | 16 | 30 | 5 | 676 | 202 | 0.30 | 462 |
| 1987 | 639 | -0.001 | 64 | 35 | 6 | 743 | 193 | 0.26 | 517 |

### CLASS I RAILWAYS: CASH-FLOW ANALYSIS

(MILLIONS OF CURRENT $)

| | **Annual Expenditures** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **O&M** | **Land** | **W&S** | **M&E** | **Taxes** | **Total expend-itures** | **Annual revenues** | **Revenue/ expense ratio** | **Gov't pay-ments** |
| 1982 | 5,150 | 7 | 480 | 262 | 153 | 6,052 | 4,750 | 0.79 | 982 |
| 1983 | 5,420 | 20 | 697 | 204 | 157 | 6,499 | 5,501 | 0.85 | 955 |
| 1984 | 5,859 | 11 | 615 | 224 | 165 | 6,875 | 6,378 | 0.93 | 574 |
| 1985 | 5,735 | 6 | 778 | 423 | 182 | 7,124 | 6,319 | 0.89 | 682 |
| 1986 | 5,637 | 6 | 634 | 228 | 196 | 6,701 | 6,282 | 0.94 | 615 |
| 1987 | 5,700 | 9 | 478 | 28 | 195 | 6,411 | 6,551 | 1.02 | 673 |

*Table 6 (cont'd)*

## *RAIL CASH-FLOW ANALYSIS (CURRENT $)*

CLASS II/III RAILWAYS: CASH-FLOW ANALYSIS
(MILLIONS OF CURRENT $)

| | Annual Expenditures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **O&M** | **Land** | **W&S** | **M&E** | **Taxes** | **Total expend- itures** | **Annual revenues** | **Revenue/ expense ratio** | **Gov't pay- ments** |
| 1982 | 525 | 1.94 | 51 | 42 | 11 | 632 | 537 | 0.85 | 32 |
| 1983 | 481 | 0.76 | 51 | 63 | 10 | 606 | 541 | 0.89 | 30 |
| 1984 | 519 | 0.89 | 517 | 31 | 11 | 1,080 | 659 | 0.61 | 28 |
| 1985 | 467 | 1.30 | 77 | 21 | 11 | 577 | 656 | 1.14 | 12 |
| 1986 | 469 | 0.35 | 91 | 13 | 11 | 585 | 638 | 1.09 | 35 |
| 1987 | 487 | 1.65 | 455 | 24 | 11 | 978 | 643 | 0.66 | 33 |

CANADIAN RAILWAYS: CASH-FLOW ANALYSIS
(MILLIONS OF CURRENT $)

| | Annual Expenditures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **O&M** | **Land** | **W&S** | **M&E** | **Taxes** | **Total expend- itures** | **Annual revenues** | **Revenue/ expense ratio** | **Gov't pay- ments** |
| 1982 | 5,675 | 9 | 531 | 305 | 164 | 6,683 | 5,288 | 0.79 | 1,014 |
| 1983 | 5,901 | 20 | 748 | 267 | 168 | 7,105 | 6,042 | 0.85 | 985 |
| 1984 | 6,378 | 12 | 1,132 | 255 | 176 | 7,954 | 7,037 | 0.88 | 602 |
| 1985 | 6,202 | 7 | 854 | 444 | 193 | 7,701 | 6,975 | 0.91 | 694 |
| 1986 | 6,106 | 6 | 725 | 242 | 207 | 7,286 | 6,921 | 0.95 | 650 |
| 1987 | 6,187 | 11 | 933 | 52 | 206 | 7,389 | 7,194 | 0.97 | 706 |

**Notes:** **Following the TC study, the revenue/expense ratio is calculated here. There is no presumption as to what its value should be, especially in the case of the cash-flow analysis.**

**As mentioned in endnote 29, capital expenditures for 1987 are not comparable to those in previous years.**

## *Table 7*
## *RAIL CASH-FLOW ANALYSIS (CONSTANT $)*

VIA RAIL: CASH-FLOW ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Annual Expenditures | | | | | | Annual revenues | Revenue/ expense ratio | Gov't pay-ments |
|---|---|---|---|---|---|---|---|---|---|
| | O&M | Land | W&S | M&E | Taxes | Total expend-itures | | | |
| 1982 | 433 | 0.272 | 2 | 8 | 2 | 445 | 118 | 0.27 | 337 |
| 1983 | 421 | 0.002 | 6 | 2 | 5 | 434 | 124 | 0.29 | 323 |
| 1984 | 377 | 0.000 | 3 | 2 | 2 | 383 | 122 | 0.32 | 276 |
| 1985 | 454 | 0.017 | 39 | 1 | 5 | 500 | 135 | 0.27 | 354 |
| 1986 | 412 | 0.053 | 11 | 21 | 3 | 447 | 133 | 0.30 | 305 |
| 1987 | 404 | -0.001 | 44 | 24 | 4 | 474 | 122 | 0.26 | 327 |

CLASS I RAILWAYS: CASH-FLOW ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Annual Expenditures | | | | | | Annual revenues | Revenue/ expense ratio | Gov't pay-ments |
|---|---|---|---|---|---|---|---|---|---|
| | O&M | Land | W&S | M&E | Taxes | Total expend-itures | | | |
| 1982 | 3,866 | 5 | 365 | 180 | 115 | 4,531 | 3,566 | 0.79 | 737 |
| 1983 | 3,877 | 14 | 523 | 134 | 112 | 4,661 | 3,935 | 0.84 | 683 |
| 1984 | 4,063 | 8 | 448 | 146 | 114 | 4,780 | 4,423 | 0.93 | 398 |
| 1985 | 3,878 | 4 | 542 | 283 | 123 | 4,830 | 4,272 | 0.88 | 461 |
| 1986 | 3,721 | 4 | 432 | 155 | 129 | 4,441 | 4,147 | 0.93 | 406 |
| 1987 | 3,603 | 6 | 323 | 19 | 124 | 4,075 | 4,141 | 1.02 | 425 |

## *Table 7 (cont'd)*
## *RAIL CASH-FLOW ANALYSIS (CONSTANT $)*

CLASS II/III RAILWAYS: CASH-FLOW ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Annual Expenditures | | | | | | Annual revenues | Revenue/ expense ratio | Gov't pay-ments |
|---|---|---|---|---|---|---|---|---|---|
| | O&M | Land | W&S | M&E | Taxes | Total expend-itures | | | |
| 1982 | 394 | 1.46 | 39 | 29 | 8 | 472 | 403 | 0.85 | 24 |
| 1983 | 344 | 0.55 | 38 | 41 | 7 | 432 | 387 | 0.90 | 22 |
| 1984 | 360 | 0.61 | 377 | 20 | 8 | 766 | 457 | 0.60 | 20 |
| 1985 | 316 | 0.88 | 53 | 14 | 8 | 391 | 444 | 1.13 | 8 |
| 1986 | 309 | 0.23 | 62 | 9 | 7 | 388 | 421 | 1.09 | 23 |
| 1987 | 308 | 1.04 | 308 | 16 | 7 | 640 | 406 | 0.64 | 21 |

CANADIAN RAILWAYS: CASH-FLOW ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Annual Expenditures | | | | | | Annual revenues | Revenue/ expense ratio | Gov't pay-ments |
|---|---|---|---|---|---|---|---|---|---|
| | O&M | Land | W&S | M&E | Taxes | Total expend-itures | | | |
| 1982 | 4,260 | 7 | 404 | 209 | 123 | 5,003 | 3,970 | 0.79 | 761 |
| 1983 | 4,221 | 15 | 561 | 175 | 120 | 5,092 | 4,322 | 0.85 | 705 |
| 1984 | 4,423 | 9 | 825 | 166 | 122 | 5,546 | 4,880 | 0.88 | 418 |
| 1985 | 4,193 | 5 | 596 | 297 | 131 | 5,222 | 4,716 | 0.90 | 469 |
| 1986 | 4,030 | 4 | 494 | 164 | 137 | 4,829 | 4,568 | 0.95 | 429 |
| 1987 | 3,911 | 7 | 631 | 36 | 130 | 4,714 | 4,547 | 0.96 | 446 |

## *Table 8*

## RAIL: BOOK-VALUE ANALYSIS (CURRENT $)

### VIA RAIL: BOOK-VALUE ANALYSIS

(MILLIONS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/ cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 5 | 291 | 295 | 0.36 | 576 | — | 47 | 3 | — | 157 | — |
| 1983 | 13 | 277 | 290 | 0.36 | 588 | 18 | 32 | 7 | 645 | 173 | 0.27 |
| 1984 | 16 | 263 | 279 | 0.36 | 543 | 17 | 34 | 3 | 596 | 175 | 0.29 |
| 1985 | 72 | 249 | 320 | 0.39 | 672 | 16 | 34 | 7 | 730 | 200 | 0.27 |
| 1986 | 85 | 264 | 350 | 0.47 | 624 | 17 | 37 | 5 | 684 | 202 | 0.30 |
| 1987 | 147 | 283 | 430 | 0.47 | 639 | 18 | 41 | 6 | 704 | 193 | 0.27 |

### CLASS I RAILWAYS: BOOK-VALUE ANALYSIS

(MILLIONS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/ cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 4,344 | 1,912 | 6,256 | 147 | 5,150 | — | 989 | 153 | — | 4,750 | — |
| 1983 | 4,911 | 2,001 | 6,913 | 167 | 5,420 | 245 | 772 | 157 | 6,595 | 5,501 | 0.83 |
| 1984 | 5,379 | 2,106 | 7,485 | 178 | 5,859 | 267 | 903 | 165 | 7,194 | 6,378 | 0.89 |
| 1985 | 5,995 | 2,403 | 8,398 | 184 | 5,735 | 288 | 888 | 182 | 7,094 | 6,319 | 0.89 |
| 1986 | 6,449 | 2,487 | 8,936 | 190 | 5,637 | 324 | 940 | 196 | 7,097 | 6,282 | 0.89 |
| 1987 | 6,733 | 2,366 | 9,099 | 200 | 5,700 | 343 | 866 | 195 | 7,105 | 6,551 | 0.92 |

*Table 8 (cont'd)*

## RAIL: BOOK-VALUE ANALYSIS (CURRENT $)

CLASS II/III RAILWAYS: BOOK-VALUE ANALYSIS

(MILLIONS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 674 | 276 | 950 | 51 | 525 | — | 150 | 11 | — | 537 | — |
| 1983 | 705 | 322 | 1,027 | 52 | 481 | 37 | 115 | 10 | 643 | 541 | 0.84 |
| 1984 | 1,201 | 334 | 1,535 | 53 | 519 | 40 | 185 | 11 | 756 | 659 | 0.87 |
| 1985 | 1,241 | 335 | 1,576 | 54 | 467 | 56 | 167 | 11 | 701 | 656 | 0.94 |
| 1986 | 1,295 | 328 | 1,623 | 54 | 469 | 57 | 171 | 11 | 708 | 638 | 0.90 |
| 1987 | 1,711 | 332 | 2,044 | 56 | 487 | 59 | 195 | 11 | 751 | 643 | 0.86 |

CANADIAN RAILWAYS: BOOK-VALUE ANALYSIS

(MILLIONS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 5,018 | 2,188 | 7,206 | 198 | 5,675 | — | 1,139 | 164 | — | 5,288 | — |
| 1983 | 5,616 | 2,324 | 7,940 | 219 | 5,901 | 282 | 887 | 168 | 7,238 | 6,042 | 0.83 |
| 1984 | 6,580 | 2,440 | 9,019 | 231 | 6,378 | 308 | 1,088 | 176 | 7,950 | 7,037 | 0.89 |
| 1985 | 7,236 | 2,737 | 9,974 | 238 | 6,202 | 344 | 1,055 | 193 | 7,794 | 6,975 | 0.89 |
| 1986 | 7,744 | 2,815 | 10,559 | 245 | 6,106 | 381 | 1,111 | 207 | 7,805 | 6,921 | 0.89 |
| 1987 | 8,445 | 2,698 | 11,143 | 256 | 6,187 | 401 | 1,061 | 206 | 7,855 | 7,194 | 0.92 |

## *Table 9*

## *RAIL: INFLATION-ADJUSTED ANALYSIS (CONSTANT $)*

VIA RAIL: INFLATION-ADJUSTED ANALYSIS

(MILLIONS OF 1979 CONSTANT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/ cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 5 | 269 | 273 | 1.10 | 433 | — | 16 | 2 | — | 118 | — |
| 1983 | 11 | 255 | 266 | 1.10 | 421 | 16 | 16 | 5 | 458 | 124 | 0.27 |
| 1984 | 13 | 241 | 255 | 1.10 | 377 | 16 | 15 | 2 | 409 | 122 | 0.30 |
| 1985 | 52 | 228 | 280 | 1.12 | 454 | 15 | 17 | 5 | 491 | 135 | 0.28 |
| 1986 | 61 | 235 | 296 | 1.17 | 412 | 15 | 18 | 3 | 449 | 133 | 0.30 |
| 1987 | 103 | 244 | 347 | 1.17 | 404 | 16 | 21 | 4 | 444 | 122 | 0.27 |

CLASS I RAILWAYS: INFLATION-ADJUSTED ANALYSIS

(MILLIONS OF 1979 CONSTANT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/ cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 4,571 | 1,766 | 6,336 | 448 | 3,866 | — | 380 | 115 | — | 3,566 | — |
| 1983 | 4,957 | 1,794 | 6,750 | 462 | 3,877 | 243 | 405 | 112 | 4,638 | 3,935 | 0.85 |
| 1984 | 5,256 | 1,832 | 7,088 | 470 | 4,063 | 256 | 425 | 114 | 4,859 | 4,423 | 0.91 |
| 1985 | 5,640 | 2,006 | 7,646 | 474 | 3,878 | 268 | 459 | 123 | 4,727 | 4,272 | 0.90 |
| 1986 | 5,903 | 2,040 | 7,943 | 478 | 3,721 | 290 | 477 | 129 | 4,616 | 4,147 | 0.90 |
| 1987 | 6,049 | 1,937 | 7,986 | 484 | 3,603 | 300 | 479 | 124 | 4,506 | 4,141 | 0.92 |

**Table 9** *(cont'd)*

## RAIL: INFLATION-ADJUSTED ANALYSIS (CONSTANT $)

CLASS II/III RAILWAYS: INFLATION-ADJUSTED ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 709 | 255 | 964 | 156 | 394 | — | 58 | 8 | — | 403 | — |
| 1983 | 726 | 281 | 1,007 | 156 | 344 | 37 | 60 | 7 | 449 | 387 | 0.86 |
| 1984 | 1,081 | 284 | 1,365 | 157 | 360 | 39 | 82 | 8 | 488 | 457 | 0.94 |
| 1985 | 1,102 | 281 | 1,383 | 158 | 316 | 49 | 83 | 8 | 456 | 444 | 0.97 |
| 1986 | 1,131 | 273 | 1,404 | 158 | 309 | 50 | 84 | 7 | 451 | 421 | 0.93 |
| 1987 | 1,405 | 273 | 1,678 | 159 | 308 | 50 | 101 | 7 | 465 | 406 | 0.87 |

CANADIAN RAILWAYS: INFLATION-ADJUSTED ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 5,279 | 2,021 | 7,300 | 604 | 4,260 | — | 438 | 123 | — | 3,970 | — |
| 1983 | 5,682 | 2,075 | 7,757 | 619 | 4,221 | 280 | 465 | 120 | 5,086 | 4,322 | 0.85 |
| 1984 | 6,337 | 2,116 | 8,453 | 627 | 4,423 | 295 | 507 | 122 | 5,348 | 4,880 | 0.91 |
| 1985 | 6,742 | 2,287 | 9,029 | 632 | 4,193 | 317 | 542 | 131 | 5,183 | 4,716 | 0.91 |
| 1986 | 7,034 | 2,314 | 9,348 | 636 | 4,030 | 339 | 561 | 137 | 5,067 | 4,568 | 0.90 |
| 1987 | 7,454 | 2,210 | 9,664 | 643 | 3,911 | 350 | 580 | 130 | 4,971 | 4,547 | 0.91 |

## *Table 10*
## *RAIL: INFLATION-ADJUSTED ANALYSIS (CURRENT $)*

VIA RAIL: INFLATION-ADJUSTED ANALYSIS
(THOUSANDS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 6 | 391 | 398 | 1.47 | 576 | — | 24 | 3 | — | 157 | — |
| 1983 | 15 | 389 | 403 | 1.54 | 588 | 23 | 24 | 7 | 642 | 173 | 0.27 |
| 1984 | 18 | 370 | 388 | 1.59 | 543 | 22 | 23 | 3 | 591 | 175 | 0.30 |
| 1985 | 74 | 340 | 415 | 1.66 | 672 | 22 | 25 | 7 | 726 | 200 | 0.28 |
| 1986 | 90 | 346 | 436 | 1.78 | 624 | 22 | 26 | 5 | 678 | 202 | 0.30 |
| 1987 | 152 | 359 | 512 | 1.86 | 639 | 23 | 31 | 6 | 698 | 193 | 0.28 |

CLASS I RAILWAYS: INFLATION-ADJUSTED ANALYSIS
(THOUSANDS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 6,005 | 2,572 | 8,577 | 597 | 5,150 | — | 515 | 153 | — | 4,750 | — |
| 1983 | 6,607 | 2,737 | 9,344 | 646 | 5,420 | 338 | 561 | 157 | 6,476 | 5,501 | 0.85 |
| 1984 | 7,212 | 2,812 | 10,023 | 678 | 5,859 | 364 | 601 | 165 | 6,989 | 6,378 | 0.91 |
| 1985 | 8,090 | 2,995 | 11,085 | 702 | 5,735 | 389 | 665 | 182 | 6,971 | 6,319 | 0.91 |
| 1986 | 8,665 | 3,005 | 11,670 | 725 | 5,637 | 424 | 700 | 196 | 6,958 | 6,282 | 0.90 |
| 1987 | 8,944 | 2,850 | 11,794 | 766 | 5,700 | 440 | 708 | 195 | 7,044 | 6,551 | 0.93 |

## *Table 10 (cont'd)*

## *RAIL: INFLATION-ADJUSTED ANALYSIS (CURRENT $)*

CLASS II/III RAILWAYS: INFLATION-ADJUSTED ANALYSIS
(THOUSANDS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 931 | 371 | 1,302 | 207 | 525 | — | 78 | 11 | — | 537 | — |
| 1983 | 967 | 428 | 1,396 | 218 | 481 | 51 | 84 | 10 | 626 | 541 | 0.86 |
| 1984 | 1,483 | 436 | 1,919 | 226 | 519 | 55 | 115 | 11 | 700 | 659 | 0.94 |
| 1985 | 1,581 | 420 | 2,000 | 233 | 467 | 72 | 120 | 11 | 670 | 656 | 0.98 |
| 1986 | 1,660 | 402 | 2,063 | 239 | 469 | 73 | 124 | 11 | 677 | 638 | 0.94 |
| 1987 | 2,077 | 402 | 2,479 | 251 | 487 | 74 | 149 | 11 | 720 | 643 | 0.89 |

CANADIAN RAILWAYS: INFLATION-ADJUSTED ANALYSIS
(THOUSANDS OF CURRENT $)

| Year | Capital Stock | | | | Annual Costs | | | | | Annual revenues | Revenue/cost ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net W&S stock | Net M&E stock | Net capital stock | Land stock | O&M | Depreciation | Cost of capital | Taxes | Total costs | | |
| 1982 | 6,936 | 2,943 | 9,879 | 804 | 5,675 | — | 593 | 164 | — | 5,288 | — |
| 1983 | 7,574 | 3,165 | 10,740 | 865 | 5,901 | 389 | 644 | 168 | 7,102 | 6,042 | 0.85 |
| 1984 | 8,695 | 3,248 | 11,943 | 904 | 6,378 | 418 | 717 | 176 | 7,690 | 7,037 | 0.92 |
| 1985 | 9,670 | 3,415 | 13,085 | 935 | 6,202 | 461 | 785 | 193 | 7,641 | 6,975 | 0.91 |
| 1986 | 10,326 | 3,407 | 13,733 | 964 | 6,106 | 497 | 824 | 207 | 7,634 | 6,921 | 0.91 |
| 1987 | 11,022 | 3,252 | 14,274 | 1,017 | 6,187 | 514 | 856 | 206 | 7,764 | 7,194 | 0.93 |

# IV. CIVIL AVIATION COSTS IN CANADA, 1980–1988

## BACKGROUND AND PURPOSE

This section updates the estimates of civil aviation costs computed in the TC study. The data and methodology used in the TC study are based on earlier work done at the CTC.[38] Both studies used detailed information to arrive at their results but, unfortunately, similar data are no longer available. This work utilizes aggregative information from alternative sources. The results are therefore not strictly comparable to those of the TC or earlier studies.

## DATA AND METHODOLOGY

Data on civil aviation expenditures are available in the Public Accounts, the Estimates and from Statistics Canada. Consolidated Government Expenditure on the air mode is taken to represent the total expenditure on civil aviation.[39] Some adjustments are made to this series prior to use.[40] Data on total expenditures on the air mode are available for the period 1978 to 1985. Those on total expenditures on transportation and communications are available for the period 1978 to 1988. It is assumed that the air mode's share of expenditures on transportation and communications is constant over the period 1985 to 1988. The 1985 share (10.25 percent) is used to derive total expenditures on civil aviation for the period 1986 to 1988.

Federal government expenditures on civil aviation are reported on an annual basis in the Public Accounts and the Estimates. These are reported as being spent by Transport Canada. The Estimates show not only estimated expenditures, but also report actual expenditures with a two-year lag. Capital and O&M expenditure[41] data are obtained from the Estimates.[42]

The information in the Estimates is not entirely consistent over the sample period because of organizational and other changes in Transport Canada. In general, the data represent expenditures on revolving fund airports, federally dependent and other airports, aviation and navigation, and regulation and administration. These classifications, however, change over the sample. It should also be mentioned that the costs of regulation by the CTC/NTA are not included in this study, nor are those of the Aviation Safety Board and the Civil Aviation Tribunal.[43]

Two alternative sets of information are used here. Total expenditures are available from Statistics Canada, and capital expenditures are available from the Estimates. O&M expenditures can then be derived as a residual. Alternatively, both capital and O&M expenditures as reported in the Estimates can be used. Total expenditures are simply the sum of these two categories. One would expect the total expenditures reported by Statistics Canada to exceed those reported in the Estimates because the former are expenditures by all three levels of government, whereas the latter are merely federal government expenditures. This, however, is not the case since Statistics Canada re-classifies the data reported in the Estimates and the Public Accounts into transportation and non-transportation expenditures. Table 11 shows the difference in the data from the two sources.

*Table 11*
ANNUAL EXPENDITURES ON AIR INFRASTRUCTURE
RATIO OF DATA FROM THE ESTIMATES TO STATISTICS CANADA DATA

| Year | O&M | Total |
|---|---|---|
| 1980 | 1.29 | 1.24 |
| 1981 | 1.30 | 1.23 |
| 1982 | 1.26 | 1.21 |
| 1983 | 1.23 | 1.18 |
| 1984 | 1.20 | 1.13 |
| 1985 | 1.08 | 1.05 |
| 1986 | 1.14 | 1.10 |
| 1987 | 1.08 | 1.05 |
| 1988 | 1.10 | 1.07 |

As already noted, the TC study covers the period 1969 to 1979. Data obtained for the air mode commence in 1978. Although the information for the two overlapping years is not incorporated in this study, it can be used to check the integrity of the information used here.

Table 12 shows data obtained from the Estimates and from Statistics Canada (SC) and compares both sources to the information reported in the TC study (TC). A ratio of data from each source to that reported in the TC study[44] is also reported.

*Table 12*
*AIR INFRASTRUCTURE: EXPENDITURES*
*(THOUSANDS OF CURRENT $)*

**Total Expenditures on Air Infrastructure**

| Year | Estimates | SC | TC | Est./TC | SC/TC |
|---|---|---|---|---|---|
| 1978 | 725,471 | 601,836 | 651,000 | 1.11 | 0.92 |
| 1979 | 733,803 | 581,165 | 603,000 | 1.22 | 0.96 |

**Air Infrastructure Operating and Maintenance Expenditures**

| Year | Estimates | SC | TC | Est./TC | SC/TC |
|---|---|---|---|---|---|
| 1978 | 570,704 | 447,069 | 490,000 | 1.16 | 0.91 |
| 1979 | 648,525 | 495,887 | 515,000 | 1.26 | 0.96 |

**Air Infrastructure Capital Expenditures**

| Year | Estimates | TC | Est./TC |
|---|---|---|---|
| 1978 | 154,767 | 161,000 | 0.96 |
| 1979 | 85,278 | 88,000 | 0.97 |

To recapitulate, capital expenditure data are taken from the Estimates. O&M expenditure data are available from two sources, the Estimates and Statistics Canada. Hence, this study provides one estimate of capital stock and two estimates of the total costs of civil aviation services provided from the public purse.

The TC study classifies capital expenditures into that on land and that on other capital. The data available for the current study do not permit this classification. It is assumed that there is no investment in land over the period 1980 to 1988. This assumption may not be entirely unrealistic since the TC study shows that the stock of land is constant over the period 1976 to 1979.[45]

The results of the cash-flow analysis are presented below in Tables 13A and 13B. The former uses Statistics Canada data and the latter uses data from the Estimates. Both current and constant dollar magnitudes are presented. Capital expenditures are deflated using an investment price deflator for air transport.[46] O&M expenditures are deflated using the implicit GDP deflator.[47]

### *Table 13A*
### AIR INFRASTRUCTURE: CASH-FLOW ANALYSIS
### ANNUAL EXPENDITURES — STATISTICS CANADA DATA

| Year | (millions of current $) | | | (millions of 1979 constant $) | | |
|---|---|---|---|---|---|---|
| | O&M | Capital | Total | O&M | Capital | Total |
| 1980 | 548 | 119 | 667 | 496 | 119 | 615 |
| 1981 | 636 | 171 | 807 | 519 | 155 | 674 |
| 1982 | 731 | 171 | 902 | 549 | 143 | 691 |
| 1983 | 782 | 255 | 1038 | 560 | 205 | 765 |
| 1984 | 832 | 460 | 1292 | 577 | 353 | 929 |
| 1985 | 846 | 445 | 1291 | 572 | 361 | 933 |
| 1986 | 829 | 425 | 1254 | 547 | 352 | 899 |
| 1987 | 874 | 412 | 1286 | 553 | 351 | 903 |
| 1988 | 894 | 448 | 1342 | 543 | 402 | 945 |

### *Table 13B*
### AIR INFRASTRUCTURE: CASH-FLOW ANALYSIS
### ANNUAL EXPENDITURES — THE ESTIMATES DATA

| Year | (millions of current $) | | | (millions of 1979 constant $) | | |
|---|---|---|---|---|---|---|
| | O&M | Capital | Total | O&M | Capital | Total |
| 1980 | 710 | 119 | 828 | 642 | 119 | 761 |
| 1981 | 825 | 171 | 996 | 673 | 155 | 828 |
| 1982 | 921 | 171 | 1092 | 691 | 143 | 834 |
| 1983 | 965 | 255 | 1220 | 690 | 205 | 895 |
| 1984 | 999 | 460 | 1459 | 693 | 353 | 1045 |
| 1985 | 914 | 445 | 1360 | 618 | 361 | 979 |
| 1986 | 949 | 425 | 1374 | 627 | 352 | 978 |
| 1987 | 942 | 412 | 1354 | 596 | 351 | 946 |
| 1988 | 983 | 448 | 1432 | 598 | 402 | 999 |

The cash-flow analysis treats all costs as current costs. Total costs are the sum of capital and O&M costs. The book-value analysis requires the construction of a gross capital stock series. This is nothing but cumulative nominal investment. Subtracting the accumulated depreciation in any year from the gross capital stock in that year yields the net stock or the book value of the assets.

The TC study used the straight line method of depreciation. Calculation of depreciation for the years 1980 to 1988 requires knowledge of depreciation rates and of past nominal investments. The TC study derived its capital stocks from highly disaggregated information on investment and depreciation. This paper utilizes a single investment series. Implied in the TC study was some composite depreciation rate for aggregate investment. Since it is not possible to infer the composite decay rate, alternative measures have to be employed. Transport Canada provided estimates of composite depreciation rates for airports (4.5 percent) and aviation (6.7 percent). This analysis uses an average of the two rates (5.6 percent) as the decay rate for civil aviation capital. The implied asset life is approximately 18 years. Depreciation expenses in 1980 will therefore depend on investments made in the 18 years prior to 1980.

Nominal total investment for the period 1954 to 1968 is available from the CTC study on air infrastructure.[48] Investment for the period 1969 to 1979 is reported in the TC study.[49] Calculation of depreciation also requires knowledge of investment in land, since land is not depreciated. Real investment in land (in 1968 dollars) for the period 1955 to 1968 is calculated by taking first differences of the stock of land reported in the CTC study.[50] The implicit GNE deflator is used to convert real investment to nominal investment.[51] Nominal investment in land for the period 1970 to 1979 is derived in a similar manner since the TC study reports the nominal stock of land for the period 1969 to 1979.[52] This leaves the year 1969. It is assumed that the 1970 share of land in total investment (about 42 percent) prevailed in the previous year.

Investment in "other" capital is derived by subtracting the nominal investment in land from nominal total investment. A depreciation rate of 5.6 percent is used.[53] The depreciation expense in 1980 includes depreciation over the period 1963 to 1980. Since the composite depreciation rate of the TC study may differ from the one used here, there is an inherent bias in our results.

Following the TC study, the cost of capital is obtained by multiplying the net stock by the prime lending rate.[54] Total cost is the sum of O&M expenditures, depreciation and the cost of capital.

The inflation-adjusted analysis follows the same method as the book-value analysis. The difference lies in the fact that all expenditures are deflated to remove the effects of inflation. As mentioned earlier, O&M expenditure is deflated using the implicit GDP deflator, and capital expenditure is deflated using the investment price deflator for air transport. Following the TC study, a 6 percent cost of capital is used in the inflation-adjusted analysis.

The inflation-adjusted analysis is also presented in "current" terms. This amounts to a revaluation of the constant dollar magnitudes in current year dollars. The gross and net capital stocks and depreciation expense derived in the inflation-adjusted analysis (at 1979 prices) are inflated to current-year dollars, using the price deflators described above. The cost of capital is assumed to be 6 percent of the inflated net stock. Total annual cost is the sum of depreciation, the cost of capital and O&M expenditures.

## RESULTS

The results of the cash-flow analysis were presented earlier in Tables 13A and 13B. It is clear that irrespective of the data source, real expenditures on civil aviation have increased in Canada over the period 1980 to 1988. The Statistics Canada data show a somewhat larger increase in total costs. Real capital expenditure has nearly doubled in the nine-year period. According to the Statistics Canada data, real O&M expenditures are higher by about $50 million in 1988 compared to 1980. The data from the Estimates, however, register a decline of about $40 million.

The results of the book-value analysis are shown in Table 14. The nominal stock of capital has more than doubled over the period 1980 to 1988. Irrespective of the data source, the total annual costs in 1988 are found to exceed those in 1980 by over $500 million. The Statistics Canada data register a higher increase.

In a recent discussion paper,[55] Transport Canada reported the net book value of civil aviation infrastructure as being $2,278 million in 1987-88. It is interesting to note that this paper found the net capital stock to be $2,289 million for the same year.

Tables 15A and 15B present the results of the inflation-adjusted analysis. Table 15A shows that, in real terms, the net stock of capital has increased by about $830 million over the sample. The real total costs in 1988 exceed those in 1980 by about $75 million. The Statistics Canada data, however, show an increase that is more than twice that shown by the data from the Estimates.

*Table 14*
AIR INFRASTRUCTURE: BOOK-VALUE ANALYSIS
(MILLIONS OF CURRENT $)

| Year | Capital Stock | | Annual Costs | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | O&M SC | O&M Est. | Depre-ciation | Total cost of capital | Total costs SC | Total costs Est. |
| 1980 | 2,248 | 1,001 | 548 | 710 | 96 | 143 | 786 | 948 |
| 1981 | 2,419 | 1,069 | 636 | 825 | 103 | 206 | 945 | 1,134 |
| 1982 | 2,589 | 1,129 | 731 | 921 | 111 | 178 | 1,020 | 1,210 |
| 1983 | 2,845 | 1,261 | 782 | 965 | 123 | 141 | 1,046 | 1,228 |
| 1984 | 3,305 | 1,575 | 832 | 999 | 146 | 190 | 1,168 | 1,335 |
| 1985 | 3,750 | 1,852 | 846 | 914 | 169 | 196 | 1,211 | 1,279 |
| 1986 | 4,175 | 2,087 | 829 | 949 | 189 | 220 | 1,238 | 1,358 |
| 1987 | 4,586 | 2,289 | 874 | 942 | 210 | 218 | 1,302 | 1,370 |
| 1988 | 5,035 | 2,505 | 894 | 983 | 232 | 271 | 1,397 | 1,487 |

*Table 15A*
AIR INFRASTRUCTURE: INFLATION-ADJUSTED ANALYSIS
(MILLIONS OF 1979 CONSTANT $)

| Year | Capital Stock | | Annual Costs | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | O&M SC | O&M Est. | Depre-ciation | Total cost of capital | Total costs SC | Total costs Est. |
| 1980 | 4,364 | 1,482 | 496 | 642 | 147 | 89 | 732 | 878 |
| 1981 | 4,519 | 1,486 | 519 | 673 | 152 | 89 | 760 | 914 |
| 1982 | 4,662 | 1,474 | 549 | 691 | 154 | 88 | 791 | 934 |
| 1983 | 4,867 | 1,518 | 560 | 690 | 161 | 91 | 811 | 941 |
| 1984 | 5,220 | 1,697 | 577 | 693 | 174 | 102 | 853 | 969 |
| 1985 | 5,581 | 1,868 | 572 | 618 | 190 | 112 | 874 | 920 |
| 1986 | 5,932 | 2,017 | 547 | 627 | 203 | 121 | 871 | 951 |
| 1987 | 6,283 | 2,149 | 553 | 596 | 218 | 129 | 900 | 943 |
| 1988 | 6,685 | 2,315 | 543 | 598 | 235 | 139 | 917 | 972 |

### *Table 15B*

### *AIR INFRASTRUCTURE: INFLATION-ADJUSTED ANALYSIS*

*(MILLIONS OF CURRENT $)*

| Year | Capital Stock | | Annual Costs | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | O&M SC | O&M Est. | Depre-ciation | Total cost of capital | Total costs SC | Total costs Est. |
| 1980 | 4,345 | 1,475 | 548 | 710 | 147 | 89 | 784 | 945 |
| 1981 | 4,975 | 1,635 | 636 | 825 | 167 | 98 | 901 | 1,090 |
| 1982 | 5,587 | 1,766 | 731 | 921 | 185 | 106 | 1,022 | 1,212 |
| 1983 | 6,063 | 1,891 | 782 | 965 | 200 | 113 | 1,096 | 1,278 |
| 1984 | 6,810 | 2,214 | 832 | 999 | 227 | 133 | 1,192 | 1,359 |
| 1985 | 6,882 | 2,304 | 846 | 914 | 234 | 138 | 1,218 | 1,287 |
| 1986 | 7,163 | 2,435 | 829 | 949 | 245 | 146 | 1,220 | 1,340 |
| 1987 | 7,372 | 2,521 | 874 | 942 | 256 | 151 | 1,282 | 1,350 |
| 1988 | 7,462 | 2,585 | 894 | 983 | 262 | 155 | 1,311 | 1,401 |

# APPENDIX 1

## DATA SOURCES FOR ROAD COSTS IN CANADA

1) Transport Canada, *Annual Report of the Interdepartmental Highway Committee*, Vol. 1. 1987-88. IHC Secretariat, Highway Branch, Transport Canada. This report provides federal highway expenditures for the period 1975-76 to 1987-88.

2) Council of Ministers Responsible for Transportation and Highway Policy, *National Highway Policy Study For Canada — Steering Committee Report on Phase 2*. National Highway Policy Steering Committee. (November 1989). Appendix C of this report provides data on national highway system revenues and expenditures by federal and provincial governments for the period 1983-84 to 1987-88.

3) Transport Canada reports:

   a) *Government Expenditures on Transportation by Province 1985/86–1988/89*. Transport Canada (TP 7064-E). March 1990.
   b) *Government Expenditures on Transportation by Province 1983/84–1986/87*. Transport Canada (TP 7064). March 1988.
   c) *Government Expenditures on Transportation by Province 1981/82–1984/85*. Transport Canada (TP 7064). 1985.
   d) *Federal and Provincial Government Transportation Expenditures by Province 1974/75–1981/82*. Transport Canada (TP 2726). November 1982.

   These reports provide federal and provincial expenditures on all the modes of transportation.

4) The Roads and Transportation Association of Canada also collects data on highway expenditures; however, it cannot provide data from the mid-1970s on.

5) "National and Provincial Economic Impact of National Highway Policy — Final Report." Prepared for Roads and Transportation Association of Canada by Informetrica Ltd., November 1989. (Mimeographed). This report contains data on investment in highways by level of government in 1989 dollars for the period 1961 to 1987.

6) Statistics Canada has published the following Service Bulletins:

a) Catalogue No. 53-006, July 1984, 13, No. 3.
b) Catalogue No. 53-002, February 1986, 2, No. 3.
c) Catalogue No. 53-002, January 1987, 3, No. 2.
d) Catalogue No. 53-002, November 1987, 3, No. 5.

These Service Bulletins contain data on federal and provincial expenditures on roads for some years between 1981-82 and 1985-86. Haritos had drawn the majority of his data from a Statistics Canada publication: *Road and Street Length and Financing* (Catalogue No. 53-201). The last year for which data are available from this source is 1976. The survey was then cancelled and nothing has replaced it.

# APPENDIX 2

## DATA TABLES

*Table A-2.1*
*(MILLIONS OF 1968 $)*

| Year | Gross capital stock | Real investment | Deflator | Nominal investment |
|---|---|---|---|---|
| 1955 | 4,398 | — | — | — |
| 1956 | 4,672 | 274 | 1.027 | 281 |
| 1957 | 5,008 | 336 | 0.954 | 321 |
| 1958 | 5,322 | 314 | 0.861 | 270 |
| 1959 | 5,727 | 405 | 0.863 | 350 |
| 1960 | 6,256 | 529 | 0.850 | 450 |
| 1961 | 6,889 | 633 | 0.767 | 485 |
| 1962 | 7,566 | 677 | 0.797 | 540 |
| 1963 | 8,308 | 742 | 0.851 | 632 |
| 1964 | 9,180 | 872 | 0.899 | 784 |
| 1965 | 10,180 | 1,000 | 0.979 | 979 |
| 1966 | 11,167 | 987 | 1.054 | 1,041 |
| 1967 | 12,122 | 955 | 1.014 | 969 |
| 1968 | 12,977 | 855 | 1.000 | 855 |

**Notes:** 1) Column 2, Gross capital stock is reproduced from Haritos (1973), Table II-1, p. 148.

2) The deflator in column 4 is the Highway Construction Price Index, Base 1971.

*Table A-2.2*

*(MILLIONS OF CURRENT $)*

| Year | Gross capital stock | Nominal investment | Stock of land | Investment in land | Total capital expenditure |
|---|---|---|---|---|---|
| 1969 | 14,603 | — | 892 | — | 1,120 |
| 1970 | 15,732 | 1,129 | 938 | 46 | 1,174 |
| 1971 | 17,195 | 1,463 | 993 | 55 | 1,518 |
| 1972 | 18,757 | 1,562 | 1,052 | 59 | 1,621 |
| 1973 | 20,547 | 1,790 | 1,119 | 67 | 1,857 |
| 1974 | 22,742 | 2,195 | 1,203 | 84 | 2,279 |
| 1975 | 25,129 | 2,387 | 1,295 | 92 | 2,479 |
| 1976 | 27,508 | 2,379 | 1,389 | 94 | 2,474 |
| 1977 | 30,144 | 2,636 | 1,493 | 104 | 2,740 |
| 1978 | 33,196 | 3,052 | 1,620 | 127 | 3,178 |
| 1979 | 36,295 | 3,099 | 1,743 | 123 | 3,222 |

**Notes:**

1) Column 2, Gross capital stock and column 4, Stock of land are reproduced from *Transport Costs and Revenues in Canada* (1982), Table 4.3, p. 33.

2) The last column is reproduced from *Transport Costs and Revenues in Canada* (1982), Table 4.1, p. 30.

### *Table A-2.3*

| Year | Construction Price Index | | | Implicit GDP deflator | | Prime lending rate |
|---|---|---|---|---|---|---|
| | Base 71 | Base 81 | Spliced Base 79 | Base 81 | Base 79 | |
| 1960 | 72.1 | — | 0.311 | — | — | — |
| 1961 | 65.0 | — | 0.280 | — | — | — |
| 1962 | 67.6 | — | 0.291 | — | — | — |
| 1963 | 72.2 | — | 0.311 | — | — | — |
| 1964 | 76.2 | — | 0.328 | — | — | — |
| 1965 | 83.0 | — | 0.357 | — | — | — |
| 1966 | 89.4 | — | 0.385 | — | — | — |
| 1967 | 86.0 | — | 0.370 | — | — | — |
| 1968 | 84.8 | — | 0.365 | — | — | — |
| 1969 | 88.7 | — | 0.382 | — | — | — |
| 1970 | 92.7 | — | 0.399 | — | — | — |
| 1971 | 100.0 | — | 0.431 | — | — | — |
| 1972 | 105.1 | — | 0.453 | — | — | — |
| 1973 | 118.3 | — | 0.509 | — | — | — |
| 1974 | 158.7 | — | 0.683 | — | — | — |
| 1975 | 177.5 | — | 0.764 | — | — | — |
| 1976 | 185.1 | — | 0.797 | — | — | — |
| 1977 | 198.2 | — | 0.854 | — | — | — |
| 1978 | 214.4 | — | 0.923 | 74.2 | 0.909 | — |
| 1979 | 232.2 | — | 1.000 | 81.6 | 1.000 | — |
| 1980 | 262.8 | — | 1.132 | 90.2 | 1.105 | 14.25 |
| 1981 | 311.6 | 100.0 | 1.342 | 100.0 | 1.225 | 19.29 |
| 1982 | 329.3 | 104.7 | 1.405 | 108.7 | 1.332 | 15.81 |
| 1983 | 346.3 | 108.6 | 1.457 | 114.1 | 1.398 | 11.17 |
| 1984 | 374.0 | 113.2 | 1.519 | 117.7 | 1.442 | 12.06 |
| 1985 | 379.8 | 117.9 | 1.582 | 120.7 | 1.479 | 10.58 |
| 1986 | — | 114.7 | 1.539 | 123.6 | 1.515 | 10.52 |
| 1987 | — | 111.2 | 1.492 | 129.1 | 1.582 | 9.52 |
| 1988 | — | 114.0 | 1.530 | 134.3 | 1.646 | 10.83 |

**Notes:** 1) Column 2 shows the "Old" Highway Construction Price Index, Base 1971.

2) Column 3 shows the "New" Highway Construction Price Index, Base 1981.

3) Column 4 shows the Spliced Index, Base 1979.

# APPENDIX 3

## DATA

Total revenue is the total operating revenue (rail)

O&M expenditure is derived as follows:

Total Rail Expenses

Less:

Track and roadway depreciation

Buildings depreciation

Signals, communications and power depreciation

Special W&S depreciation

Locomotives depreciation

Freight cars depreciation

Passenger cars depreciation

Intermodal equipment depreciation

Work equipment and roadway machines depreciation

Other equipment depreciation

Special equipment depreciation

Taxes, other than income

Way and structures capital comprises the following:

- Track and roadway
- Buildings and related machinery and equipment
- Signals, communications and power
- Terminals and fuel stations

Machinery and equipment capital comprises the following:

- Rolling stock-revenue services
- Intermodal equipment
- Work equipment and roadway machines
- Other equipment

*Table A-3.1*

| Year | W&S deflator | M&E deflator | Capital deflator | GDP deflator | Prime rate |
|---|---|---|---|---|---|
| 1982 | 1.314 | 1.457 | 1.363 | 1.332 | 15.81 |
| 1983 | 1.333 | 1.526 | 1.391 | 1.398 | 11.17 |
| 1984 | 1.372 | 1.535 | 1.419 | 1.442 | 12.06 |
| 1985 | 1.434 | 1.493 | 1.453 | 1.479 | 10.58 |
| 1986 | 1.468 | 1.473 | 1.464 | 1.515 | 10.52 |
| 1987 | 1.479 | 1.471 | 1.470 | 1.582 | 9.52 |

# APPENDIX 4

## DATA TABLES

### *Table A-4.1*
### DEFLATORS

| Year | Implicit GDP deflator | Capital deflator |
|---|---|---|
| 1979 | 1.000 | 1.000 |
| 1980 | 1.105 | 0.996 |
| 1981 | 1.225 | 1.101 |
| 1982 | 1.332 | 1.198 |
| 1983 | 1.398 | 1.246 |
| 1984 | 1.442 | 1.305 |
| 1985 | 1.479 | 1.233 |
| 1986 | 1.515 | 1.207 |
| 1987 | 1.582 | 1.173 |
| 1988 | 1.646 | 1.116 |

### *Table A-4.2*
### DATA USED IN CALCULATING PAST DEPRECIATION (MILLIONS OF $)

| Year | Total investment current $ | Investment in land 1968 $ | Investment in land current $ | Implicit GNE deflator | Capital deflator |
|---|---|---|---|---|---|
| 1963 | 38 | 7 | 6 | 0.843 | 0.390 |
| 1964 | 42 | 3 | 2 | 0.864 | 0.404 |
| 1965 | 40 | 3 | 3 | 0.892 | 0.423 |
| 1966 | 51 | 2 | 2 | 0.931 | 0.450 |
| 1967 | 45 | 5 | 4 | 0.968 | 0.480 |
| 1968 | 59 | 3 | 3 | 1.000 | 0.482 |
| 1969 | 68 | — | 29 | — | 0.511 |
| 1970 | 90 | — | 38 | — | 0.504 |
| 1971 | 127 | — | 53 | — | 0.543 |
| 1972 | 100 | — | 13 | — | 0.568 |
| 1973 | 286 | — | 93 | — | 0.605 |
| 1974 | 253 | — | 26 | — | 0.650 |
| 1975 | 151 | — | 39 | — | 0.705 |
| 1976 | 121 | — | 18 | — | 0.783 |
| 1977 | 198 | — | 0 | — | 0.815 |
| 1978 | 161 | — | 0 | — | 0.897 |
| 1979 | 88 | — | 0 | — | 1.000 |

## ENDNOTES

1. Haritos, Z. *Rational Road Pricing Policies in Canada* (Ottawa: Canadian Transport Commission, 1973).

2. Transport Canada, *Transport Costs and Revenues in Canada* (The TC study) Ottawa, July 1982).

3. Some of the data were obtained by a special request from Statistics Canada.

4. Statistics Canada, *Consolidated Government Finance* (Ottawa, December 1987), Catalogue No. 68–202. (Data for more recent years were obtained by special request from Statistics Canada.)

5. See Haritos, *Rational*, Table 6.1, p. 48.

6. Henceforth, any reference to total road expenditures is a reference to this adjusted total.

7. See Table 4 in B. E. Hicks, *RTAC Road Infrastructure Study*, in Proceedings of 23rd Annual Meetings of the Canadian Transportation Research Forum (Saskatoon: University of Saskatchewan Printing Services, 1988), pp. 526–36.

8. Table 4.1 in Transport Canada, *Transport Costs*.

9. From Table II-1 in Appendix 2 in Haritos, *Rational*.

10. See Table A-2.1, Appendix 2.

11. From Table 4.5 in Transport Canada, *Transport Costs and Revenues*.

12. See Table A-2.2, Appendix 2 of this paper.

13. The methodology used in the TC study was used by Haritos in an earlier work in 1973 which covers the period 1955 to 1968. The 1973 piece used a road life of 20 years, as confirmed in Table II.1 of that work. The 1982 TC study makes the same assumption but the tables in that study seem to indicate asset lives of 25 to 27 years depending on the year.

14. Statistics Canada, *Canadian Economic Observer, Historical Statistical Supplement 1990/91* (Ottawa, July 1991), Catalogue No. 11-210.

15. The deflators are reported in Table A-2.3, Appendix 2.

16. Statistics Canada, *National Income and Expenditure Accounts, The Annual Estimates* (Ottawa, December 1989), Catalogue No. 13-201.

17. This is taken from Statistics Canada, *Construction Price Statistics* (Ottawa, August 1990), Catalogue No. 62-007. For the period 1981 to 1988, the new index (base 1981) is used; for the years prior to 1981, the old index (base 1971) is spliced with the new index.

18. The implied d[illegible]eciation method is exponential decay.

19. Real inve[illegible]t in land for the period 1956 to 1968 was converted to nominal terms, using the implicit GNE deflator. Then the nominal series for the period 1956 to 1988 was deflated by the implicit GDP deflator. The real investment series and the deflators are reported in the Addendum to Section II, Table S-7.

20. The benchmarks (in millions of 1968 constant dollars) are $2,580 and $541 for capital and land respectively. See Table II-1, Appendix 2, in Haritos, *Rational.*

21. The depreciation rate is merely the inverse of the asset life.

22. Using a discount rate of 6 percent.

23. As before, a 6 percent cost of capital is used.

24. For the period 1956 to 1968, the gross capital stock and the stock of land valued in 1968 dollars are similar to those reported by Haritos. This is not the case for the remainder of the period. Unless there was a dramatic increase in road investment in 1969, the TC study is not entirely consistent with the earlier work of Haritos.

25. Z. Haritos, *National Railroad System Annual Costs and Revenues 1956-1970,* (Ottawa: Canadian Transport Commission, Economics Branch, 1973). See also Z. Haritos, "Transport Costs and Revenues in Canada," *Journal of Transport Economics and Policy* 9, 1 (January 1975).

26. These accounts provide investment expenditure data.

27. Statistics Canada, *Railway Transport in Canada: General Statistics* (Ottawa, 1982-1986), Catalogue No. 52-215; and *Rail in Canada* (Ottawa, 1987), Catalogue No. 52-216.

28. Details are reported in Appendix 3.

29. The additions to each category of capital are taken to represent investment expenditures. For 1987, additions are not reported, so the difference between the end-of-year balance and the beginning-of-year balance is taken to represent investment expenditure. This introduces a bias in investment expenditures in 1987 since, unlike other years, retirements are, in effect, netted from gross additions in that year.

30. See Table A-3.1, Appendix 3. The source is Statistics Canada, *National Income and Expenditure Accounts.*

31. Both indexes are reported in Table A-3.1, Appendix 3. The source is Statistics Canada, *Price Indexes for Capital Expenditures on Plant and Equipment (1986=100) — By Industry —Manufacturing and Non-Manufacturing Industries 1926-1990* (Ottawa, 1990), PUB 11.

32. This is taken from the accumulated depreciation accounts reported by Statistics Canada.

33. This value is taken from the property accounts published by Statistics Canada.

34. D. W. Caves and L. R. Christensen, "Productivity in Canadian Railroads, 1956-1975," CTC Research Report No. 10-78-16 (Ottawa: Canadian Transport Commission, 1978).

35. Statistics Canada, *Canadian Economic Observer.*

36. The ratios for 1979 are 1.38, 1.35 and 4.05 for W&S capital, M&E capital and land respectively.

37. Since depreciation expenses include those on W&S and M&E, the implicit price index for capital expenditures (total components) for the railway transport industry is used as a deflator. See Table A-3.1, Appendix 3, capital deflator.

38. Z. Haritos and J. D. Gibberd, *Civil Aviation Infrastructure Annual Costs and Revenues 1954-1968* (Ottawa: Canadian Transport Commission, Economics Branch, 1972). See also Haritos, "Transport Costs and Revenues in Canada."

39. Statistics Canada, *Consolidated Government Finance.*

40. The sum of $649,785,000 is deducted from the expenditures on the air mode in 1980. This amount is a deletion in accordance with the *Adjustments of Accounts Act;* details are available on page 29-11 of the *Public Accounts of Canada* for the fiscal year 1980-81.

41. Part III of the Estimates reports expenditures of revolving fund airports in the section on the Airports Authority Group. Further details are also provided toward the end of the document under the heading of Supplementary Information. The data used in this section are not taken from the Supplementary Information because the operating expenses reported therein include depreciation and certain other items.

42. For more recent years this information is reported in Part III of the Estimates for Transport Canada.

43. This information can be incorporated at a later stage.

44. From Table 2.1 in Transport Canada, *Transport Costs and Revenues.*

45. According to the TC study, the stock of land in current dollars is $421 million over the period 1976 to 1979. In constant 1979 dollars it is $949 million.

46. See Table A-4.1, Appendix 4. The source is Statistics Canada, *Price Indexes for Capital Expenditures on Plant and Equipment.*

47. See Table A-4.1, Appendix 4. The source is Statistics Canada, *National Income and Expenditure Accounts.*

48. See Table 12 in Haritos and Gibberd (1972).

49. See Table 2.1 in Transport Canada, *Transport Costs and Revenues in Canada.*

50. See Table 2 in Haritos and Gibberd, *Civil Aviation Infrastructure.*

51. Haritos and Gibberd use the GNE deflator to deflate investment in land.

52. See Table 2.2 in Transport Canada, *Transport Costs and Revenues in Canada.*

53. See Table A-4.2, Appendix 4 for details on the data.

54. Statistics Canada, *Canadian Economic Observer.*

55. Transport Canada, *Proposed New Cost Recovery Policy: Phase II Discussion Paper* (Ottawa, April 1990), TP 10041.

# 12

# ROAD COSTS

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November 1991

## SUMMARY

This report describes a preliminary costing study for federal, provincial and territorial roads. It is "preliminary," as more work is required to firm up the data needed for costing purposes: vehicle populations, vehicle characteristics, road costs in individual provinces, etc. Further, where allocation techniques are used, they are, for the most part, borrowed from other studies. No attempt is made to relate the estimated costs to road prices or taxes.

The first step was to assemble information developed by the Transportation Association of Canada (TAC) on road lengths and annual costs. This was then substantially modified both to correct errors and to produce a cost profile of Canadian roads satisfying an analysis of optimal pavement strength. The third step was to develop a profile of vehicles and traffic conditions. More research is required in this area before a precise calculation of road costs is possible. The final step was to calculate road costs.

Road costs were calculated in two ways. First, the methodologies used in studies in the United States, the United Kingdom and Australia were modified to the extent possible and married to the Canadian data. Further, an exploratory Canadian procedure was developed (although not fully tested).

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The results of these allocations are interesting, but not robust enough to base strong conclusions about the appropriate allocation of costs in Canada. Second, an attempt was made to estimate a cost function and develop marginal pavement costs for a standard axle load. (Other aspects of the marginal cost of road use were not investigated.) This attempt uses typical construction costs in Southern Ontario and a model of pavement performance also based on Ontario roads. It is difficult to extend the analysis to other provinces in the absence of appropriate models of pavement deterioration.

A summary of some of the estimates is contained in the table. Only two vehicle classes are shown: the car, and the large truck where "large" means a registered weight of 4.5 tonnes or more. For the first three allocation methodologies shown, costs are an average of all federal, provincial and territorial roads. Municipal or urban roads were not included within the scope of this research.

### *SUMMARY OF (SELECTED) ROAD-COST ESTIMATES*

| **Methodology** | **Costs per kilometre (1989 cents)** | | **Comment** |
|---|---|---|---|
| **Cost-allocation methods** | **Auto** | **Truck** | |
| 1. U.S. 1982 FHWA | 0.5 | 6.1 | • On-going maintence excluded |
| 2. U.K. DoT | 1.0 | 14.2 | • Environmental factors excluded |
| 3. Australian | 1.9 | 7.5 | • Judged to be most appropriate method for Canadian conditions |
| 4. Exploratory methodology | | | |
| – freeways | 0.5 | 2.0 | Assumptions require testing; better data would improve the results. |
| – high-volume highway | 0.8 | 3.0 | |
| – low-volume highway | 5.2 | 14.7 | |
| **Marginal pavement cost** | | | |
| – high-volume freeway | 0.0 | 0.8 | May be problems estimating MC for roads with little truck traffic. |
| – high-volume highway | 0.0 | 7.1 | |
| – low-volume highway | 0.0 | 112.5 | |

The costs shown under the fourth allocation methodology, the "exploratory" one developed here, are for the road classes indicated. Marginal pavement costs, which are only estimated for intercity paved highways, are shown for three levels of traffic volume which, in this context, means the number of annual axle loads. For the lowest-volume roads — technically, those with less than 15,000 standard axle loads annually — marginal costs are very high (75 cents per standard axle load). It may be, however, that the model of pavement performance used to calculate this is not particularly accurate at these low levels.

In undertaking this work, three issues were addressed:

1) Have pavements been designed with sufficient strengths? In the United States, recent research suggests that pavements are too thin and, as a result, have had to be resurfaced sooner than planned. The consequence is that road costs for heavy trucks are higher than they otherwise would be. (Thicker or stronger pavements mean lower costs for a given axle load.) No evidence has been found to indicate that the same is true in Canada.

2) Are governments spending enough on the roads to prevent unnecessary and costly deterioration? An argument has been made in Canada that the infrastructure is crumbling and governments are falling behind in the amount they spend on roads. The consequence, the argument goes, is that, in the long run, taxpayers will have to foot the bill for an expensive rehabilitation program. If all of this is true, there are significant ramifications for a road costing exercise (costs would be much higher than those developed from actual expenditure data).

This "infrastructure is crumbling" argument is complex and not all aspects are investigated here. It may be that a road left to deteriorate will cost more in the long run than a road which is well maintained throughout its lifetime. This has not been investigated.

What this research has investigated, however, is whether the "infrastructure is crumbling" thesis is based on facts. After adjusting for problems in TAC's data — apparent adding mistakes and the failure to distinguish between *preserving* and *preserving and upgrading* roads — the calculations suggest that the annual expenditures required to maintain the existing roads are approximately $4 billion. This is just about the amount governments are spending. The conclusion, therefore, is that the data do not support the thesis that roads are falling apart. This investigation has nothing to do with a related argument heard recently that governments should spend more on roads to increase capacity. Capacity issues are not addressed in this study.

3) What are the relative contributions of axle loads and environmental factors to pavement deterioration? The answer to this question has a significant bearing on a costing study as it determines the costs allocated to large trucks with heavy axle loads. While there is no simple answer applicable to all roads in all regions of Canada, there is no doubt that environmental factors do play a large role in pavement deterioration. On the strongest pavements with the highest levels of truck traffic, the split between load-related and environmental-related deterioration may be in the order of 50:50. On low-volume roads in regions of Canada where the climate is harsh — for example, most of the roads in the Prairies — environmental factors may account for 80 percent or more of the deterioration.

# GLOSSARY

| | |
|---|---|
| AADTs | **Average Annual Daily Traffic** (or, sometimes, just **ADT** for average daily traffic, or **AADTT** for truck traffic). These are measures of traffic volumes. In this report, they are generally expressed on a **two-lane equivalent basis** (the exceptions being where AADTs from source material are being discussed). |
| AASHO | The former name of AASHTO (American Association of State Highway and Transportation Officials). In the text, important empirical tests of the relationship between axle loadings and pavement performance are referred to as the "AASHO Road Tests." |
| ESAL | **Equivalent-Single-Axle Load**, or **Equivalent-Standard-Axle Load**. There are a number of similar terms in use (for example, **LEF** or **load-equivalency factor**). They all have the same purpose: to reduce different axle configurations and different masses to one standard measure in terms of the effect of axles on pavements. In the text, ESAL and LEF are used interchangeably, although there is a tendency to use the ESAL more often when discussing the equivalency factors developed in the AASHO Road Tests and LEF when discussing other equivalency factors. |
| FHWA | **Federal Highway Administration** of the U.S. Department of Transportation. |
| GVW | **Gross Vehicle Weight**. A number of other terms are in widespread use (gross vehicle mass, gross combination weight, etc.), but in this report GVW is used throughout. It differs from RGVW in that it is a measure of the actual weight of a truck. |
| LEF | **Load-Equivalency Factor**. See ESAL. |
| NHS | **National Highway System**. This 33,169-kilometre (two-lane equivalent) network of highways has been labelled "National" by the Transportation Association of Canada. |

| | |
|---|---|
| Maintenance | In this report, **maintenance** means expenditures which are not considered in the provincial accounts as capital expenditures. This differs from usage in other studies where maintenance includes such activities as resurfacing. In other studies **routine maintenance** might be used to describe activities referred to here as maintenance. |
| OPAC | **Ontario Pavement Analysis of Costs**. This is a model of pavement deterioration which can separate the effects of load and environment. In this report, it is the primary model used to reach conclusions in respect to pavement behaviour and costs. |
| PCE | **Passenger-Car-Equivalent**. There are a number of other similar terms (for example, **PCUs**). These attempt to measure capacity use in a consistent fashion. One truck might equal two PCEs whereas a car equals one PCE. For this reason, PCE-km are sometimes used to allocate certain road costs. |
| RCI | **Riding Comfort Index**. This is a common measure of pavement serviceability in Canada, equivalent to twice the PSI index in the U.S. |
| RGVW | **Registered Gross Vehicle Weight**. The weight at which a truck is licensed to operate. |
| SN | **Structural Number** is a measure of pavement strength. |
| TAC | The **Transportation Association of Canada**, formerly **RTAC** or the **Roads and Transportation Association of Canada**. The data base developed in this study is based on TAC data. |
| Tandem Axle | A group of two axles on a truck with a suspension system which shares the load between the axles. |
| Tridem Axle | A group of three axles on a truck with a suspension system which shares the load among the axles. |
| VKT | **Vehicle Kilometres of Travel** |
| VMT | **Vehicle Miles of Travel** |

# 1. INTRODUCTION

## 1.1 PURPOSE OF RESEARCH

The purpose of this research is to identify road costs which may be attributed to various classes of vehicles using federal, provincial and territorial roads. The Terms of Reference define the mandate as follows:

> Identification of the contributions of different classes of motor vehicles to the total costs of rural highway infrastructure and operations. Estimation of the roadway costs per vehicle-kilometre for passenger cars, light trucks/vans, buses, and heavy trucks in major weight classes.

In this work, the following questions are addressed:

- Has the "under built" thesis any validity in Canada ("Were pavements designed with less than optimal strength?") and, if so, has this any bearing on road costing?
- Has the "under maintained" thesis any validity ("We are not spending enough on our roads to maintain them.") and, if so, what implications are there for road costing?
- What are the relative contributions of traffic loads and of time (aging or the environment) to pavement deterioration?
- What is the impact of procedures used in other allocation studies? In other words, "What would be the level of allocated costs in Canada if the methodologies of earlier, generally non-Canadian, studies were used?"

## 1.2 SCOPE

While the objectives sound ambitious, there are qualifications pertaining to the scope of the research. Of most importance, no new data have been collected. In fact, it was not possible even to undertake a comprehensive survey of all the data which already exist in a variety of bewildering formats in each province. The research was conducted within the following constraints:

- The starting point for all information on roads, in terms of system length by road class, and in terms of unit road costs (maintenance, resurfacing and reconstruction costs per kilometre) was the Transportation Association of Canada's (TAC's) data on infrastructure.
- TAC's information on unit road costs and frequencies (that is, how often are roads of a particular class resurfaced?) was analyzed to determine how well it measures road costs. Adjustments were made both to correct obvious errors and to recalculate what are called "optimum" costs — "optimum" because they are developed after considering optimum pavement durability. These adjustments were based on illustrative road sections in a model of pavement deterioration, using typical construction costs from one province. This *is not* the same as conducting an actual investigation of all (or a sample of all) roads in Canada.
- Other aspects of TAC's data have been adjusted on the basis of partial or incomplete information regarding expenditures by provincial highway agencies. For example, only a small amount of information from four provinces has been reviewed to answer the question, "What portion of annual maintenance is related to pavement and, hence, susceptible to wear from axle loadings?" A more thorough analysis might find a different answer for every jurisdiction and every class of road under a range of traffic conditions.
- The traffic and vehicle data used — for example, the proportion of large trucks in the traffic stream and the loads on these trucks — are not based on extensive surveys *or* comprehensive sources. Readily accessible information has been analyzed and extrapolated over the entire network.
- The costing done in this research uses "national averages" or "typical construction costs" for many calculations. Given the known variability in conditions from one province to another — traffic volumes, the type of trucks, and the nature of road costs — these figures may be misleading. However, the alternative of developing information on each class of road in each of 16 jurisdictions was not possible within the scope of this project.

Finally, since the subject of road costs is controversial, it must also be noted that this report makes no attempt to relate costs either to road prices or to any of the various measures of total road revenues such as fuel taxes. The intention was only to allocate or compute costs. The research considered the existing roads *as if* they were the product of efficient investment decisions in the past. No attempt was made to examine the non-road components of the total road costs (policing, vehicle licensing, private user-costs, etc). Nor did the study consider the cost of new roads or capacity additions to existing roads. Finally, no consideration was given to externalities (air pollution, etc.).

## 2. THE PHYSICAL CHARACTERISTICS OF ROADS

### 2.1 INTRODUCTION

A prerequisite to the development of a costing methodology is an understanding of the physical properties of roads. (What do heavy axle loads do to pavements?) Further, since this research uses a variety of costing methodologies within the context of a Canadian data base, it is important to sort out the assumptions made about roads. Otherwise, there is a danger that existing methodologies will be used inappropriately. Finally, the mandate for this research poses three questions, all of which require an understanding of the physical nature of roads. This section provides an overview of road engineering which focusses on pavements and pavement deterioration as this component of a road represents the largest cost item, at least for the road agency.[1]

### 2.2 ROAD DESIGN

Aspects of road design which play a role in cost allocation are:

*Capacity:* The primary determinant of capacity is the number of lanes on a road, including passing and climbing lanes as well as the more common four (or more) lane approach used on freeways. These capacity considerations are important in some cost-allocation studies. Often, the method of calculating a vehicle's use of capacity is to reduce it to a measure such as the passenger-car-equivalent (PCE).

*Bridges:* Bridges are built to carry loads. A consequence is that cost-allocation studies tend to use vehicle weight as a means of allocating bridge costs. For example, the costs of a given base bridge may be calculated and treated as a common cost while any costs for a bridge stronger than this are treated as a function of vehicle weight (GVW) or registered gross vehicle weight (RGVW).

*Horizontal and vertical geometry:* Roads have geometric features — widths, grades, clearances, curvatures — which can be related to vehicle characteristics. For example, grading costs, which determine the vertical geometry, may be assigned on the basis of weight-to-power ratios. Pavement widths may be assigned on the basis of vehicle widths.

*Pavements:* Pavements are designed with a certain strength, partly determined by the number of expected axle loads. These are measured with a load equivalency factor (LEF), the most common one being the 18,000-pound equivalent-single-axle-load (ESAL) developed in the U.S. Most recent costing studies critically depend on this concept. For example, new pavement costs may be allocated on the basis of treating a minimum pavement thickness as a common cost; any costs over and above this minimum are a function of ESALs.

These design characteristics are used in allocation studies for the purpose of assigning the costs of new roads. The data used in this study, however, are for the cost of the existing roads. This being the case, many of the design-vehicle-characteristic linkages are not made.

## 2.3 PAVEMENTS

### 2.3.1 Introduction

The principal pavement used in Canada is a flexible pavement consisting of granular base and sub-base courses and a surface course of asphaltic concrete. This section focusses exclusively on these flexible pavements — an important point since much of the controversy surrounding road costing emanates from recent work in the United States where rigid pavements are more common.

The initial design choice for a flexible pavement is the number of years it will last before a resurfacing is required. This pavement life may be lengthened by increasing the thickness (described later in Figure 2.5) and/or by using better quality materials. Table 2.1 shows typical structures for flexible pavements in three provinces.

*Table 2.1*

**TYPICAL PAVEMENT STRUCTURES**

| | New Brunswick | Ontario | Alberta |
|---|---|---|---|
| Asphaltic concrete | 140–201 mm | 50–130 mm | 80–100 mm |
| Granular base course or asphalt stabilized base | 150 mm | 150 mm | 50 mm |
| Granular sub-base | 455–760 mm | 150–450 mm | 180–330 mm |

The thickness of the components may be converted into equivalent granular thicknesses using the following layer equivalencies: surface = 2; granular base = 1; sub-base = 0.67. Using these, the following numbers illustrate the range of equivalent granular thicknesses in different provinces with a variety of sub-grade and traffic conditions:

| | Weak sub-grade Heavy traffic | Strong sub-grade Light traffic |
|---|---|---|
| New Brunswick | 1,090 mm | 750 mm |
| Ontario | 700 mm | 350 mm |
| Alberta | 615 mm | 420 mm |

The thicker pavements required in New Brunswick reflect the poor quality sub-grades in that province. Alberta has the smallest range of thicknesses because most of the pavement deterioration there is due to the harsh climate. These environmental aspects of deterioration are discussed more fully in a later section. Alberta also uses an asphaltic stabilized base course because of the unavailability of good granular material in much of the province.

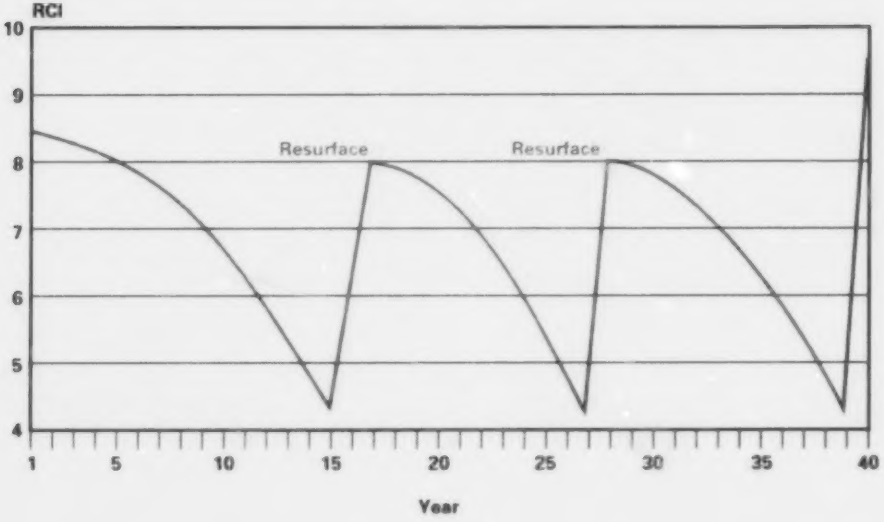
Flexible pavements wear out or deteriorate over time. The FHWA in the United States identified three major types of deterioration (Rilett et al., 1989):

- *Surface distress:* fatigue cracking, low-temperature cracking, rutting, ravelling, bleeding or flushing, roughness due to differential sub-grade volume change.
- *Reduction in surface friction:* reduced skid resistance.
- *Reduction in serviceability:* increased roughness. Reduction in serviceability is also caused by surface distress since the distress normally creates roughness.

For this discussion, it is the third type of deterioration which is of interest as this is the primary operating function of a pavement. In many allocation procedures, this is the measure which can be related to vehicle operating costs (that is, increased roughness means increased vehicle operating costs). In Canada, roughness, or the riding quality of a pavement, is usually measured with the Riding Comfort Index (RCI), a subjective estimate rated on a scale of 0 to 10. The change in RCI over time is usually monitored through objective measures of pavement distortion which have been correlated with the subjective ratings.

New pavements typically have an initial RCI of 8.5. This decreases as the surface distorts under the action of traffic load and climate. On first-class highways, pavements are normally considered to have deteriorated to an unacceptable condition when the RCI has declined to a level of 4.5 (see Figure 2.1). At year 15 and again at year 27, the pavement is resurfaced with an overlay which would vary from about 50 mm on lightly travelled highways to about 90 mm on heavily travelled highways. Generally, flexible pavements in Canada will be resurfaced twice in 40 to 50 years before a decision is made to reconstruct the pavement.

*Figure 2.1*
*Pavement Deterioration Over Time*



### 2.3.2 Pavement Deterioration

The principal mechanisms contributing to the surface distortion of flexible pavements are permanent deformations of the surface created by traffic loads and deformations of the sub-grade which are transmitted through the pavement structure to the surface. Deformation of the sub-grade occurs under the stresses imposed by heavy axle loads, and by freeze-thaw cycles and sub-grade moisture changes. The distortion of pavement surfaces induced by climatic factors is a significant component of pavement deterioration, and flexible pavements deteriorate to an unacceptable RCI magnitude in 25 to 35 years even under very light traffic loads.

The AASHO Road Test conducted in Illinois during the early 1960s provides most of the information known about the impact of traffic loads on pavement deterioration. In this test, the behaviour of pavements of different thicknesses subjected to different truck axle configurations (single and tandem) and axle group loads was observed over a two-year period. Many of the flexible pavement test sections failed very quickly at the beginning of the second spring thaw due to a combination of poor sub-base quality and a sub-grade which was quite sensitive to freeze-thaw cycles. This compromised the development of statistically valid axle coverage damage functions because of the narrow range of axle coverage within which pavements failed. In contrast, many of the thicker reinforced concrete pavement sections (rigid pavements) had not deteriorated to an unacceptable condition by the end of the test, which also created difficulties in the development of statistically valid deterioration models, particularly for the thick, rigid pavement sections. As well, the test sections at the road test were subjected to about one million axle loads over the two-year period: This creates difficulties when pavement deterioration models based on this try to predict behaviour beyond this loading range.

In Canada, the Brampton Test Road has provided information for extending the knowledge developed at the AASHO Road Test to typical operating conditions where traffic loads are imposed at a slower rate. The Brampton Road Test also allowed the contribution of climatic factors to pavement deterioration to be tracked in an objective manner.

In subsections 2.3.4 to 2.3.6, deterioration models are examined in more detail. First, though, the concept of load equivalency is considered.

### 2.3.3 Load Equivalency

A concept central to deterioration models is the relative pavement damage of different axle loads. In the AASHO Road Test, a standard load was defined as 18,000 lb (8,163 kg) on a single axle supported by dual tires (that is, four tires per axle). This was the common limit for single axles in much of the United States and Canada in the early 1960s. The equivalent single-axle load rating of any other axle load or configuration, ESAL or LEF, is defined as the number of passes of the standard axle load required to create the same amount of damage as one pass of a candidate axle load. For example, a single axle load of 10,000 kilograms (22,050 lb) has an ESAL rating or LEF of 2.25. This is calculated from what is commonly referred to as the "fourth-power law" of pavement damage:

$$\mathrm{LEF} = \left(\frac{L(x)}{L(s)}\right)^4$$

where $L(x)$ is the candidate axle load and $L(s)$ is the standard axle load.[2]

To put the issue in dramatic terms, this 10,000-kilogram truck axle (the maximum load limit in three Canadian jurisdictions) does 160,000 times as much damage to a flexible pavement as does a car axle load of 500 kilograms. That is, the truck's ESAL of 2.25 is 160,000 times as large as the car's 0.000014 ESALs. This concept of load equivalency, and the manner in which these equivalencies increase sharply with load, is of crucial importance in all modern costing studies.

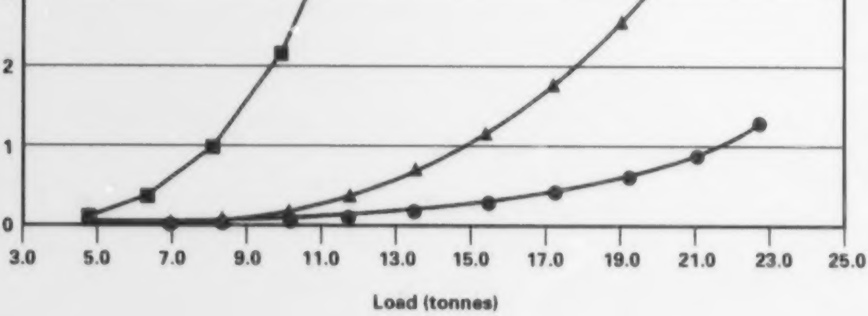
Whatever other controversies exist, most people agree on this point: heavy axle loads (hence, trucks) are a major factor in deterioration (hence, costs).

The current AASHTO ESALs, dating from 1986, were developed from the AASHO Road Tests and additional experimental and theoretical information (see Figure 2.2). The actual calculation depends on a number of factors (pavement strength and the terminal serviceability), but for this study's purpose these complications can be ignored.

More than just load is involved in the impact axles have on pavements. Such factors as the number of tires, tire pressure, vehicle speed, axle suspensions and ambient air temperature all play a part. However, none of these has been incorporated in any of the costing performed in this research nor, as far as is known, in any other work.

Recent Canadian research has developed its own method of calculating LEFs, referred to here as Canroad or Waterloo LEFS, depending on how they are calculated (Appendix B). While it is not possible to describe all the recent research on the relationship between axles and pavements, these Canadian LEFs should be mentioned. First, they are based on actual empirical data from a series of pavement test sites across Canada. Unlike other LEFs, then, they represent Canadian climates, pavements, axle configurations and loads. Second, there is an important implication which flows from the development of these LEFs: they suggest that the damage of a heavy axle is greater than those calculated from AASHTO's LEFs. To illustrate, a typical large truck which might be rated at three ESALs as calculated from AASHTO's numbers, could be rated at six or seven as calculated from these Canadian LEFs. The important point is that use of the Canadian LEFs affects the *relative* distribution of pavement damage (hence, costs) among truck types.

*Figure 2.2*
*AASHTO Load Equivalencies*



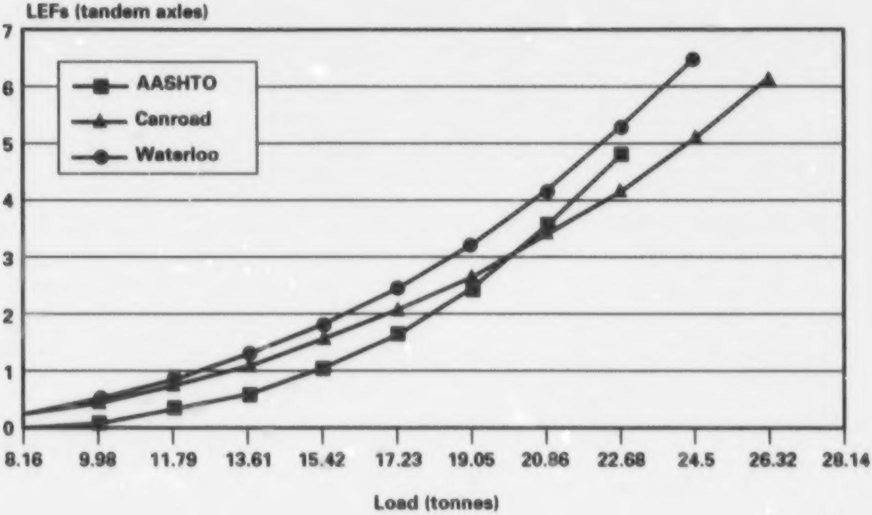
A comparison of the AASHTO, Canroad and Waterloo LEFs for tandem axles is shown in Figure 2.3. For example, at 15.4 tonnes, the AASHTO LEF of 1.09 is considerably lower than the Canroad 1.59 or the Waterloo 1.86. There is a 70 percent difference in what these equivalency factors reveal about the impact of axles on pavements. For most of this research, however, AASHTO's ESALs are used as this is the way pavement deterioration models are calibrated.

To this point, the discussion has focussed on the importance of LEFs in pavement deterioration. Obviously, to the extent deterioration is synonymous with costs, LEFs also play a key role in costing. In fact, one of the studies reviewed in Section 6 simply takes total pavement costs, divides by the number of ESALs, and attributes the resulting cost per ESAL to trucks in proportion to the number of ESALs each truck creates. While this approach may be necessary because of data constraints, it is naïve in the sense that it attributes all aspects of pavement costs to ESALs. There are environmental impacts on pavements (discussed in the next subsection). Second, even if the impact of the environment can be accounted for separately, there is the problem that the simple notion of LEFs as outlined here — the so-called "fourth-power law" — is not responsible for all aspects of pavement performance. As outlined in subsection 2.3.1, there are a number of dimensions to pavement deterioration such as surface distress, skid resistance and roughness. Some are related to axle loads in a manner captured in the pavement deterioration models as indicated by the AASHTO ESALs; some, such as skid resistance, are not; and still others, such as the various forms of distress, are related to axle loads in a manner which differs from the "fourth-power" ESAL.

> . . . the Road Test only measured serviceability loss rather than the individual pavement distress contributing to that loss. Since different distresses occur as different functions of axle loadings, there may be substantial error in attributing the relative causes of deterioration for any given combination of distresses. (U.S. FHWA, 1982, p. IV-45)

In this FHWA study, a series of distress models was constructed to allocate existing pavement costs. This cannot be done here, but it can be recognized that the naïve use of LEFs in determining pavement costs may introduce errors to the analysis.

*Figure 2.3*
*COMPARISON OF LEFS*



### 2.3.4 Models of Pavement Deterioration (1)

One of the reasons for the controversy surrounding the subject of costing is the wide choice of pavement-deterioration models. For this research, three are relevant:

- The OPAC model, the most relevant for Canadian conditions (Jung et al., 1975).
- The Alberta model which has particular relevance for low-volume roads in harsh climates (Cheetham and Christiso[illegible]981).
- The model developed by Small, Winston and Evans (1989) in the United States which has generated some of the recent controversy.

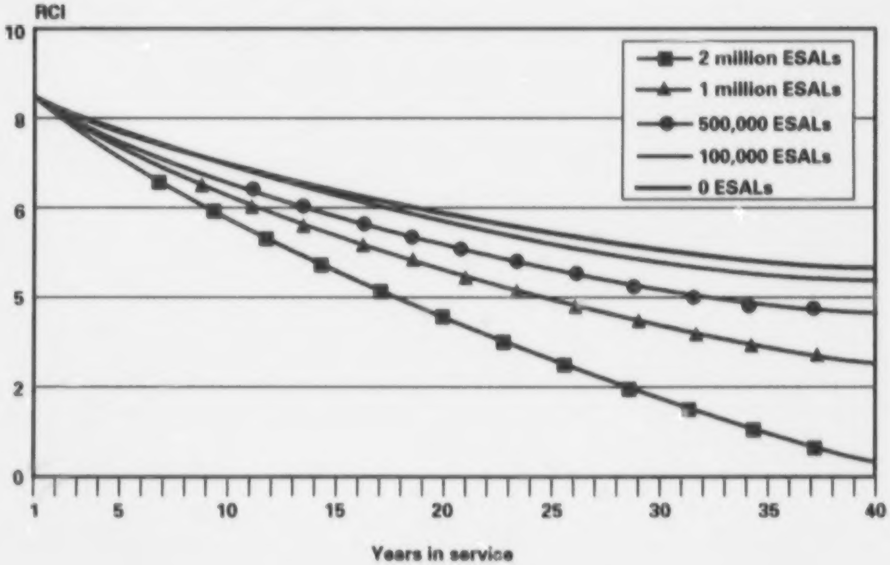
Other models, such as those developed by the World Bank (Paterson, 1987), are also important but, as they consider roads in developing countries with traffic and climatic conditions far different from those in Canada, they are not considered here.

The Ontario flexible pavement deterioration model, OPAC, provides one of the few models which separates load from climate-associated deterioration.

It was developed from the behaviour observed at the AASHO Road Test, the theoretical behaviour of layered elastic systems, and the longer-run Brampton Road Test. Briefly, this is how it works. A proposed pavement structure (see Table 2.1 for an example) is converted to an equivalent thickness of granular material covering a sub-grade. The deflection of the sub-grade likely to occur under a standard wheel load is then estimated using a theoretical procedure. The expected traffic loading (ESAL coverage) is then used along with this sub-grade deflection to estimate the loss in RCI over time due to traffic. The loss in RCI due to the environment is estimated in terms of the sub-grade deflection and the number of years in service. The OPAC model also contains a procedure for estimating the probable life span of overlays, although there are concerns about the validity of this component of the model.

Typical results from the OPAC model are depicted in Figure 2.4; the family of curves shown are for total annual ESAL loadings of zero, 100,000, 500,000, one million and two million. "SN" is the structural number, that is, the strength of the pavement.

*Figure 2.4*
*RCI Profile, Using OPAC Model*
*(SN = 4.9)*



As illustrated, pavements deteriorate to an unacceptable level of roughness (an RCI below 4.5) in about 40 years in the absence of any axle loads. (The OPAC model may actually overestimate pavement lives in the absence of axle loads.) With one million axle loads, an RCI of 4.5 is reached in about 20 years; with two million ESALs, an RCI of 4.5 is reached in about 14 years. Only a few sections of the busiest freeways in Canada experience more than two million ESALs a year.

The curves also indicate that both axle loads and the environment play a role in pavement deterioration. Further, the relative importance of environmental factors *decreases* with heavier loadings (Rilett et al., 1989). For example, for a typical flexible pavement in Southern Ontario, the environment may account for as much as 80 percent of the deterioration on a low-volume road (less than 250,000 ESALs per year). On a high-volume road, say over two million ESALs per year, environmental factors may only account for half the pavement deterioration. The same is true for overlays: the higher the traffic volumes (axle loads), the lower the portion attributable to the environment.

Another point which emerges from this model is that the role of the environment *increases* with longer initial pavement lives (Rilett et al., 1989). Again, the same is true for overlays.

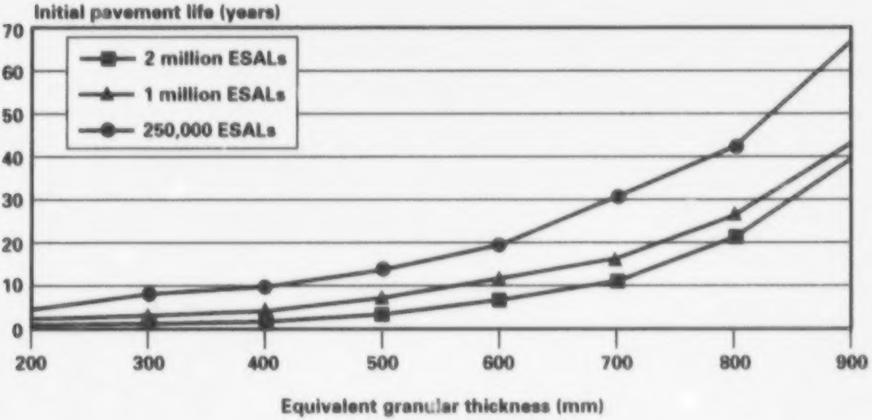
To oversimplify, the environment grows in importance as stronger and thicker pavements are built (for a given demand loading), and it grows in importance as traffic volumes (axle loads) decline. To turn this around, axle loads play a larger role in deterioration where pavements are built for short initial lives, and where traffic volumes are high. Although this sounds relatively straightforward, there is a qualification:

> While pavements in more severe climates may well have to be designed primarily for environmental factors (. . . i.e., they are "over-designed" for traffic loading, per se), it would be dangerous to extrapolate this too far. For example, if a pavement were designed only for environmental factors, and an unexpected increase in traffic loads occurred, then very rapid deterioration would likely occur. . . . Moreover, existing models such as OPAC assume that environmental and load-associated deterioration is separable right to the end of the

> service life. In reality, the interaction between traffic and environment may be the dominant factor in deterioration as the pavement becomes older. (Rilett et al., 1989, p. 39)

A final characteristic of pavements, as revealed by the OPAC model, is shown in Figure 2.5. Pavements exhibit increasing returns to scale, as shown by the fact that pavement life increases with pavement thickness ("equivalent granular thickness") *at an increasing rate.*

*Figure 2.5*
*PAVEMENT STRENGTH AND INITIAL YEARS TO FAILURE*



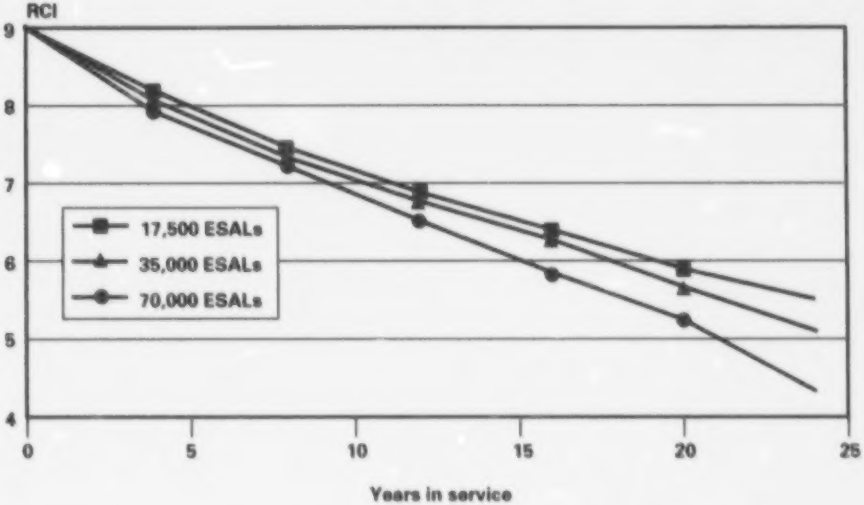
### 2.3.5 Models of Pavement Deterioration (2)

The Alberta model is based on data from a large number of pavement sections, some as old as 25 years. Recursive regression equations were developed, and the truck loading variable was found to be weakly significant. Pavement deterioration as a function of pavement life, for three levels of annual axle loads, is shown in Figure 2.6.

The model indicates that, for the light traffic loads and harsh climates in Western Canada, the environment causes most deterioration. For example, with annual ESALs of 17,500, an RCI below 4.5 is reached in about 26 years. With four times this loading, the model predicts an RCI below 4.5 in about 22 years. This observation reinforces the argument that where traffic is light, environmental factors play the largest role in pavement deterioration.

*Figure 2.6*

*RCI PROFILE, USING ALBERTA MODEL*



### 2.3.6 Models of Pavement Deterioration (3)

The final deterioration model to be considered is the one developed by Small, Winston and Evans which supports the claim that pavements have been built without sufficient durability and that, accordingly, pavement costs for trucks are higher than they would be with optimally-designed pavements. (In summarizing Small, Winston and Evans, it should be pointed out that most of their argument is concerned with rigid pavements. While they extend the discussion to flexible pavements, they point out that they are not as confident of the results.)

The following is the model they propose, based on their re-analysis of the AASHO Road Test data:

$$\mathrm{RCI}(t) = \mathrm{RCI}(0) - [\mathrm{RCI}(0) - \mathrm{RCI}(f)] \left(\frac{Qt}{N}\right) e^{mt}$$

The Canadian RCI (a 0-to-10 scale) has been used in the above rather than the American PSI (a 0-to-5 scale), but this does not affect the results. RCI($t$) is the serviceability index at time $t$, RCI(0) is the initial serviceability and

RCI($f$) is the terminal serviceability (that is, the point at which the pavement is resurfaced). $Q$ is the number of ESAL loadings experienced, $N$ is the total ESALs-life of the pavement, and $m$ is a factor to account for the annual percentage increase in roughness due to climatic factors.

Small, Winston and Evans' re-analysis of the AASHO Road Test data for flexible pavements results in the following prediction for $N$, pavement life:

$$N = e^{12.062} (D + 1)^{7.761} (L_1 + L_2)^{-3.652} (L_2)^{3.238}$$

where $D$ is the structural number of the pavement, $L_1$ is the axle load in thousands of pounds, and $L_2$ equals 1 for single axles and 2 for tandem axles. Setting $L_1 = 18$ (that is, the 18,000-lb standard axle load) and $L_2 = 1$, the pavement performance model may be re-written as:

$$\mathrm{RCI}(t) = 8.5 - \left[\frac{4Qt}{3.7021(D + 1)^{7.761}}\right] e^{mt}$$

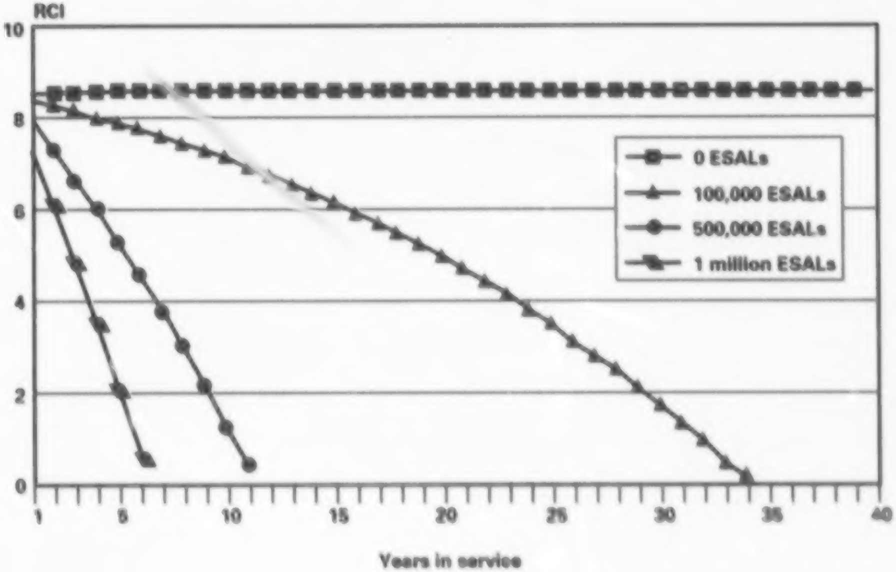
Again, RCI values have been used instead of PSI. The value "4" in the equation is simply the difference between the RCI of a new pavement and the value of RCI when resurfacing is ordinarily done.

This equation may be used to develop the RCI profile of a flexible pavement with a thickness the same as that used in Figure 2.4 (SN of 4.9). The results are shown in Figure 2.7. For this illustration, an annual increase in roughness due to climatic factors has been set at 2.3 percent. Small, Winston and Evans actually use a value of 4.0 percent for most of their calculations and the World Bank, from which these estimates were derived, suggests a figure more in the order of 5.0 to 10.0 percent for severe climates (Paterson, 1987, p. 393). There is considerable uncertainty about the value of $m$ in the above equation.

As indicated in Figure 2.7, this model allows for no deterioration in the absence of axle loads, unlike the OPAC model. The authors, while unsure about this, offer anecdotal evidence to suggest that this may actually be the case, at least for rigid pavements. A second point to note about the curves in Figure 2.7 is their relative steepness in comparison to those generated from the OPAC model (Figure 2.4). For example, with 100,000 ESALs annually, the Small, Winston and Evans pavement shown in Figure 2.7 reaches an RCI below 4.5 in about 21 years. In comparison, the OPAC model predicts that this point is reached in 37 years. With one million ESALs, an RCI of less than 4.5 is reached in about 12 years with Small, Winston and Evans. The OPAC model, with the same pavement strength, suggests this point is reached in 20 years.

A third observation about the Small, Winston and Evans model, which is not evident from Figure 2.7, is that the steepness of the curves increases for higher values of *m* — the climatic factor. For example, with 100,000 annual ESALs, a pavement will reach an RCI of 4.5 in about 13 years when the climatic factor is 7 percent as compared to the 21 years shown in Figure 2.7.

*Figure 2.7*
*RCI Profiles, Using Small, Winston and Evans Model*
*(Environmental Degradation = 2.3%; RCI = 2*PSI)*



To demonstrate the differences in pavement performance predicted by the OPAC model and the one proposed by Small, Winston and Evans, the numbers in Table 2.2 show the initial years in service of a flexible pavement under a number of annual ESAL loads. As shown, the Small, Winston and Evans model is considerably more sensitive to axle loadings than the OPAC model. This probably reflects the behaviour at the AASHO Road Test where many of the flexible pavement sections failed prematurely.

*Table 2.2*

*YEARS IN SERVICE, OPAC MODEL VERSUS SMALL, WINSTON AND EVANS MODEL*

| Annual ESALs | OPAC model | Small, Winston and Evans model | | |
|---|---|---|---|---|
| | | *m* = 0.0 | *m* = 0.023 | *m* = 0.07 |
| 100,000 | 37 | 34 | 21 | 13 |
| 500,000 | 26 | 7 | 6 | 5 |
| 1,000,000 | 20 | 3 | 3 | 3 |
| 2,000,000 | 14 | 2 | 2 | 1 |
| 4,000,000 | 10 | 1 | 1 | 1 |

The implications of the model proposed by Small, Winston and Evans are that, for a given traffic load, thicker pavements are required than those suggested by the OPAC model. Additionally, given the sensitivity to ESAL loadings in the Small, Winston and Evans model, the optimum pavement strategy would be more sensitive to the key design variable — initial pavement life — than that suggested by the OPAC model.

### 2.3.7 Roads with Other Than Flexible Pavements

Over half the roads in Canada (federal, provincial, territorial measured on a two-lane equivalent basis) do not have the flexible pavements discussed in the preceding sections. Instead, they are surface-treated, gravel or earth. To put this in perspective, however, this half of the network only accounts for about 20 percent of the total costs and a very small proportion of total travel. Whatever their cost or importance, none of the models described thus far consider these road surfaces. Although there are models available as, for example, in the work by the World Bank (Paterson, 1987), it is unlikely that these are relevant given the climates for which they have been calibrated.

For this reason, there is an important cautionary note to introduce here about the cost allocations attempted later in this report: these are done on the basis of the AASHTO ESALs and/or Canadian LEFs described previously, *even though* there is no evidence to suggest that these are appropriate.

### 2.3.8 Summary

Pavements and pavement performance are important in any road costing exercise.

The *key design variable* for pavements is the initial pavement life. The decision to build for a longer initial life has two implications: stronger pavements initially (which cost more), and a deferral of the time at which resurfacing has to occur (which reduces costs). The economic consequences of this decision are examined in Section 5.

*Heavy axle loads* play a key role in pavement deterioration, suggesting, therefore, that heavy axles bear a large portion of pavement costs.

The *environment* plays a large role in pavement deterioration (at least from the best evidence on Canadian pavements). It may be overly simplistic to attach any single number to this statement as soil, pavement and traffic conditions vary considerably. Nevertheless, environmental factors may account for half of the deterioration of the strong pavements found on the busiest freeways with a high proportion of trucks, and they may account for almost all of the deterioration of the weaker pavements found on low-volume roads with very little traffic (particularly where the climate is severe).

For the purpose of costing, the concept of *load equivalencies* for axles is indispensable. However, the naive use of LEFs — that is, linking of all aspects of pavement performance to one LEF concept — may introduce an element of error into any such exercise. Further, the choice of LEF has, as will be shown in Section 7, a pronounced impact on the results.

This section would be incomplete if mention were not made of a large-scale current pavement research project (SHRP). This is an American effort, although other countries including Canada are involved. It may well be that the knowledge about pavements, and hence costing methods, will change substantially as a result of this work. One point that emerges from the results to date is the difficulty in collecting data on pavements for the purpose of gauging performance. Long periods are involved (20 to 40 years). During this time, truck weight limits may change. Further, material properties used in construction may vary from one section to another. Of most importance, it has been found that it is extremely difficult to record accurately the history of actual axle loadings and environmental factors on any particular pavement over an extended period of time.

## 2.4 BRIDGES

Bridge costs, as will be described in Section 3, account for only 6 percent of TAC's calculation of total road costs. This is one of the reasons little attention is given to the physical characteristics of bridges here. Another is that the relationships between bridge wear and traffic are less well understood than in the case of pavements. This, at least, is the conclusion of the 1988 FHWA study which looked specifically at the question of the costs heavy trucks impose on roads:

> Design for bridges is fundamentally different from that for pavements. Bridges are built for ultimate strength and behave differently under loading than do pavements. While there is general consensus that pavement deterioration is related to the number of axle load repetitions, the state-of-the-art in bridge fatigue analysis has not advanced to the point where bridge costs can be directly related to travel by different vehicles. (U.S. DoT, 1988, p. III-8)

## 2.5 MAINTENANCE

Later sections consider maintenance, or what are sometimes referred to as "routine maintenance" costs. The unknown factors are these:

- Are maintenance activities (costs) a function of the "initial pavement life" variable in the design of pavements?
- Are maintenance activities a function of traffic (either axle loads or the number of vehicles or other measures of traffic)?
- What portion of maintenance activities are related to pavements and, hence, possibly load-related?

Unfortunately, no good answers to these questions have been found. One recent study from California does suggest a strong relationship between truck traffic and maintenance costs (Kitamura et al., 1990). The authors say that, in California, average annual maintenance costs per heavy-truck mile amount to $7.60 while for cars the cost is only $0.08. However, without knowing more about what they consider to be maintenance as compared to what the provinces include in their accounts as maintenance, it is difficult to make much of this. It is possible that the American authors include factors which in Canada are classified as resurfacing or even reconstruction.

The Trucking Research Institute report discussed maintenance costs as follows, although it appears to refer *only* to pavement-related maintenance:

> Pavement maintenance is one of the most important elements of cost allocation. . . . Unfortunately, however, no single source can be relied on as to the most appropriate methodology to use. The Federal studies have not focused on maintenance because of the lack of Federal funding for maintenance. State studies have mostly relied on expert opinion to determine the proportion of costs that is load-related, as well as to determine what the appropriate relationship is between traffic loads and pavement maintenance requirements. (The Urban Institute, Sydec, Inc., 1990, p. 80)

## 3. TAC DATA BASE ON ROAD COSTS

### 3.1 SOURCE DATA

For a number of years TAC has compiled data on roads, including information on lengths in two-lane equivalent kilometres and on costs. Although information on the entire 879,530-kilometre network is available, only the 292,003 kilometres of federal, provincial and territorial roads are of interest here. A summary is shown in Table 3.1. Only 5 percent of this network, including all the paved urban roads, is federal.

*Table 3.1*

### THE ROAD NETWORK

*(TAC'S DATA ON FEDERAL, PROVINCIAL AND TERRITORIAL ROADS, TWO-LANE EQUIVALENT BASIS)*

| Road class | Length (km) |
|---|---|
| Freeway | 13,441 |
| Paved (urban) | 1,209 |
| Paved (rural) | 129,855 |
| Surface-treated | 32,968 |
| Gravel | 109,622 |
| Earth | 4,908 |
| | **292,003** |

**Source: RTAC, 1990.**

From each of 16 jurisdictions — four federal departments, 12 provinces and territories — TAC collects information on the costs of maintaining roads and bridges. "Maintaining," in this instance, includes five activities:

- annual maintenance of the road surface and roadside (everything from snow ploughing and grass cutting to crack filling);
- periodic resurfacing;
- reconstruction of road surfaces after a certain number of resurfacing cycles;
- bridge maintenance, restoration and reconstruction; and
- administration.

A description of the methodology is provided by TAC (RTAC, 1990); an even more complete description is available in what is referred to as the "HITRIS" study (RTAC, 1987a).

The data are collected and compiled in a consistent manner which helps with one critical problem with road costing in Canada — obtaining appropriate data. Every jurisdiction has numbers; the difficulty has been in collecting and massaging them so that their meaning is consistent. Another point is that in TAC's data, "cost" is *not* what each jurisdiction actually spends on its roads. Rather, it is what TAC refers to as "needs." "This model [of needs is used] to relate typical highway expenditures to estimates of funding required to achieve an acceptable minimum standard. As such, these 'needs' are estimated theoretical levels of funding only." (RTAC, 1990, p. 17).

The advantage of using the TAC data is that it represents the "costs" of maintaining the road system indefinitely. Unlike information on expenditures, there are no fluctuations based on everything from political motives (expenditures increasing before an election) to a bad winter (and increased snow ploughing expenses). Further, there is no confusion between maintaining existing roads and adding new capacity.

If the object of a costing exercise, however, is the design of road prices, there are also disadvantages in the use of TAC's data since they do not include land costs, policing costs, or private user-costs. Further, the amounts assume past investment decisions were optimal, that is, that the size and capacity of the network are the same as would be with a network built had the road agencies received their funding from a system of efficient prices.

In TAC's latest publication, expenditure needs for the fiscal year ending in March 31, 1989 were $11.4 billion, with the federal/provincial/territorial component shown at $6.1 billion. The balance of $5.3 billion is municipal (RTAC, 1990, p. 18). However, it appears there were errors made in printing these figures as the spreadsheet from which they were derived only shows a total of $5.1 billion for federal/provincial/territorial roads.[3]

Costs used in this study, at least as a starting point, are as shown in Table 3.2. The maintenance and pavement component is described in more detail in Tables 3.2 to 3.4 as totals or averages for the whole network even though the analysis was done at the level of the individual jurisdiction. Use of the TAC data for this research, however, was conditional on the figures from individual jurisdictions being treated as confidential.

*Table 3.2*

### TAC'S ROAD COSTS (EXPENDITURE NEEDS)

(TAC'S DATA ON FEDERAL, PROVINCIAL AND TERRITORIAL ROADS, MILLIONS OF 1989 $)

| | | |
|---|---|---|
| Annual maintenance | | $1,824.0 |
| Pavement | | |
| – resurfacing | $1,477.8 | |
| – reconstruction | 1,294.9 | |
| – total | | 2,772.7 |
| Bridges | | 296.3 |
| Administration | | 201.5 |
| **Total** | | **$5,094.5** |

**Source: RTAC Lotus files.**

In Table 3.3, the total $4.6 billion in maintenance and pavement costs is shown according to class of road. Paved rural roads dominate the costs of the network, comprising as they do 68 percent of the total. Paved roads in total — that is, the first three classes on Table 3.3 — account for 78 percent of total costs. The remaining 22 percent of maintenance and pavement costs — which amount to over $1 billion — are for surface-treated, gravel and earth roads. The cost for these last three classes are allocated to road users in a later part of this study. However, as previously pointed out, the allocation is not made on the basis of any information about the performance of these surface-treated, gravel or earth surfaces.

*Table 3.3*

### TOTAL MAINTENANCE AND PAVEMENT COSTS

(TAC'S DATA ON FEDERAL, PROVINCIAL AND TERRITORIAL ROADS, TOTAL ANNUAL EXPENDITURE NEEDS, MILLIONS OF 1989 $)

| **Road class** | **Maintenance** | **Resurfacing** | **Reconstruction** | **Total** |
|---|---|---|---|---|
| Freeway | 139.2 | 100.7 | 142.3 | 382.2 |
| Paved (urban) | 5.5 | 28.5 | 12.4 | 46.4 |
| Paved (rural) | 1,005.5 | 1,269.1 | 862.7 | 3,137.3 |
| Surface-treated | 161.6 | 44.4 | 165.0 | 371.0 |
| Gravel | 494.3 | 35.2 | 110.7 | 640.2 |
| Earth | 18.0 | 0.0 | 1.8 | 19.8 |
| | **1,824.0** | **1,477.8** | **1,294.9** | **4,596.7** |

**Source: RTAC Lotus files.**

In Table 3.4, average maintenance and pavement costs are shown. These have been calculated by dividing the numbers in Table 3.3 by the lengths in Table 3.1. They indicate possible incongruities in the data base: for example, paved urban roads have an annual resurfacing cost of $23,542 per two-lane kilometre which is considerably higher than for other roads.

### Table 3.4

### Average Maintenance and Pavement Costs

(TAC's data on federal, provincial and territorial roads, annual expenditure needs per two-lane kilometre, 1989 $)

| Road class | Maintenance | Resurfacing | Reconstruction | Total |
|---|---|---|---|---|
| Freeway | 10,355 | 7,492 | 10,589 | 28,435 |
| Paved (urban) | 4,554 | 23,542 | 10,290 | 38,386 |
| Paved (rural) | 7,743 | 9,773 | 6,644 | 24,160 |
| Surface-treated | 4,901 | 1,345 | 5,003 | 11,250 |
| Gravel | 4,509 | 321 | 1,010 | 5,840 |
| Earth | 3,660 | 0 | 374 | 4,034 |

**Source:** RTAC Lotus files.

In Table 3.5, average unit costs for resurfacing and reconstruction are shown, as well as the average duration (that is, number of years between resurfacing or reconstruction). These have been calculated as weighted values; that is, the figures from individual jurisdictions have been weighted by the length of the road section there. Again they indicate that there may be some "noise" in the data base. Paved urban roads resurfaced every 3.1 years?

### Table 3.5

### Unit Costs and Frequencies

(TAC's data on federal, provincial and territorial roads, expenditure needs per two-lane kilometre, 1989 $)

| Road class | Resurfacing costs/km | Resurfacing frequency (years) | Reconstruction costs/km | Reconstruction frequency (years) |
|---|---|---|---|---|
| Freeway | 90,385 | 14.5 | 522,482 | 49.3 |
| Paved (urban) | 71,435 | 3.1 | 401,152 | 39.2 |
| Paved (rural) | 72,852 | 16.7 | 303,325 | 47.3 |
| Surface-treated | 9,840 | 5.5 | 167,280 | 34.6 |
| Gravel | 4,437 | 4.9 | 22,504 | 11.0 |
| Earth | 0 | 0.0 | 7,478 | 8.8 |

**Source:** RTAC Lotus files.

## 3.2 ADJUSTMENTS

A closer examination of TAC's data, at the level of the individual jurisdiction and individual class of road, reveals anomalies or, at least, many numbers difficult to understand. For example, in one province paved rural roads are reconstructed every 50 years and resurfaced every 45 years. This is, presumably, a coding error. As another example, in two provinces paved rural roads are resurfaced every 2.25 and 3 years respectively. This is at odds with existing practices, according to informal discussions with highway people in the two provinces. Since these two provinces account for a large portion of the total length of rural paved roads, these short resurfacing lives have a significant impact on the total road costs computed by TAC.

In light of these and other suspected errors, adjustments have been made to the original TAC data before using them. A conservative approach has been taken, with only the most extreme values in the TAC data being changed. For example, rather than trying to second guess the road agencies as to when paved roads really do require resurfacing, any value between 5 and 25 years has been accepted, and only values outside this range have been changed (to 15 years). None of the wildly different estimates of reconstruction costs have been adjusted: for freeways, these estimates varied from a low of $200,000 per two-lane kilometre to a high of $1 million.

The following is a summary of the adjustments made:

*Maintenance costs:* In three cases, jurisdictions are included in TAC's data with zero maintenance costs for a particular class of road. To adjust these, the average cost per kilometre has been used. The "average" is different than that shown on Table 3.4 as it is calculated without the road length of the candidate jurisdictions included in the denominator.

*Resurfacing costs:* The 16 road agencies are divided in their opinion (or practices) as to whether or not surface-treated, gravel and earth roads require resurfacing. Half the individual cells in the TAC matrix show a cost while the other half do not. However, *no* adjustments have been made here (no information has been found upon which to make such adjustments).

In the case of freeways and paved rural roads, there are three instances where roads are shown with a zero resurfacing cost. Again, as with maintenance, the procedure followed was to substitute a value calculated from the average of all those jurisdictions showing a cost.

*Resurfacing frequency:* By far the most significant adjustment made to TAC's data concerns the estimates provided for the average life of an overlay. In total, there are 17 instances in the data where a province is shown to resurface every four years or less, or to resurface every 26 years or more. All values lying outside the range of 5 to 25 have been changed to 15 years.

*Reconstruction:* Although reconstruction costs vary significantly from jurisdiction to jurisdiction, these have not been adjusted. Rather, they are the subject for discussion under "Pavement Economics" in Section 5.[4]

The result of these adjustments on maintenance and pavement costs is shown in Tables 3.6 to 3.8. No changes have been made to TAC's estimate of costs for bridges. Finally, a new figure has been computed for administration based on the average "add-on percentage" of 4.1 percent used in the original. The result is an estimated cost of $171.5 million. A summary of the final adjusted TAC data is shown in Table 3.9. Total costs ("needs") of $4.3 billion are considerably lower than the original TAC Lotus files ($5.1 billion) and even more significantly lower than TAC's published figures ($6.1 billion).

*Table 3.6*

*ADJUSTED TOTAL MAINTENANCE AND PAVEMENT COSTS*

*(TOTAL ANNUAL EXPENDITURE NEEDS, MILLIONS OF 1989 $)*

| Road class | Maintenance | Resurfacing | Reconstruction | Total |
|---|---|---|---|---|
| Freeway | 139.2 | 96.1 | 142.3 | 377.6 |
| Paved (urban) | 5.5 | 5.8 | 12.4 | 23.7 |
| Paved (rural) | 1,005.5 | 567.5 | 861.3 | 2,434.3 |
| Surface-treated | 167.7 | 38.0 | 165.0 | 370.6 |
| Gravel | 494.3 | 35.2 | 110.7 | 640.2 |
| Earth | 18.0 | 0.0 | 1.8 | 19.8 |
|  | **1,830.1** | **742.6** | **1,293.5** | **3,866.2** |

Table 3.7

### ADJUSTED AVERAGE MAINTENANCE AND PAVEMENT COSTS
### (ANNUAL EXPENDITURE NEEDS PER TWO-LANE KILOMETRE, 1989 $)

| Road class | Maintenance | Resurfacing | Reconstruction | Total |
|---|---|---|---|---|
| Freeway | 10,355 | 7,151 | 10,589 | 28,094 |
| Paved (urban) | 4,554 | 4,762 | 10,290 | 19,607 |
| Paved (rural) | 7,743 | 4,370 | 6,633 | 18,746 |
| Surface-treated | 5,086 | 1,153 | 5,003 | 11,242 |
| Gravel | 4,509 | 321 | 1,010 | 5,840 |
| Earth | 3,663 | 0 | 374 | 4,037 |

Table 3.8

### ADJUSTED UNIT COSTS AND FREQUENCIES
### (EXPENDITURE NEEDS PER TWO-LANE KILOMETRE, 1989 $)

| Road class | Resurfacing costs/km | Resurfacing frequency (years) | Reconstruction costs/km | Reconstruction frequency (years) |
|---|---|---|---|---|
| Freeway | 90,385 | 14.5 | 522,482 | 49.3 |
| Paved (urban) | 71,435 | 15.0 | 401,152 | 39.2 |
| Paved (rural) | 72,852 | 17.8 | 303,325 | 47.3 |
| Surface-treated | 9,840 | 5.6 | 167,280 | 34.6 |
| Gravel | 4,437 | 4.9 | 22,504 | 11.0 |
| Earth | 0 | 0.0 | 7,478 | 8.8 |

Table 3.9

### ADJUSTED TAC ROAD COSTS (EXPENDITURE NEEDS): SUMMARY
### (MILLIONS OF 1989 $)

| | | |
|---|---|---|
| Annual maintenance | | $1,830.1 |
| Pavement | | |
| – Resurfacing | $742.6 | |
| – Reconstruction | 1,293.5 | |
| – Total | | 2,036.1 |
| Bridges | | 296.3 |
| Administration | | 171.5 |
| **Total** | | **$4,334.0** |

# 4. VEHICLE AND TRAFFIC DATA

A critical aspect of a costing study is data on, or assumptions about, vehicles and traffic. Without this, it is impossible to assess TAC's costs and to allocate the results to users. The scope of this research, however, did not include the collection of new data. Therefore, the procedure followed has been to take known information from several sources (Appendix A) and extrapolate this over the entire 292,003-kilometre network. This should not be confused with characteristics developed on the basis of an actual survey: the information shown in Tables 5.1 through 5.3 is little more than an educated guess about fleet and traffic characteristics in Canada and, because of the nature of the information used, it has an Ontario bias to it.

Six aspects of vehicles and traffic are required for most cost-allocation exercises:

- Total vehicles;
- Vehicle kilometres of travel;
- Average weight measured in two ways: average actual weight or GVW and average registered weight or RGVW;
- Traffic volumes measured as AADT;
- Proportion of trucks in the AADT; and
- Average LEFs per vehicle.

Most cost-allocation studies separate vehicles into categories, sometimes by class of road. Attempts were made to do this in this study but the results, particularly when applied to provincial data on road costs, were not credible. It was found that road information (road classes by length and associated costs) could be "built up" from the level of the individual jurisdiction to the level of a national average with confidence, but that the same was not true for vehicle and traffic characteristics. Traffic volumes are considerably lower in Western Canada, for example, than in Southern Ontario. More serious was that the nature of trucks changes from one province to another. In Western Canada trucks have neither the liftable axles (which often have high LEFs) nor the high axle weights found in Eastern Canada.

The procedure adopted, therefore, was as follows. Available information from some provinces was used to develop a very aggregate national profile for vehicle and traffic characteristics. Only two truck types were recognized: large and small. Given the available data, it was not even possible to provide a precise definition of the demarcation line between "large" and "small" although for convenience it is considered here to be an RGVW of 4.5 tonnes. These aggregate data on vehicles and traffic were then used in conjunction with the TAC data to perform various cost allocations (Section 7). Once certain unit costs were developed on this basis — such as pavement costs per LEF-km — the results could then be used to develop the costs of an individual vehicle operating on a particular road — for example, a six-axle tractor-semitrailer on a paved rural road. However, because of the confidentially of the TAC data, this could not be done on a provincial basis.

The fleet and the characteristics of the vehicle classes are shown in Table 4.1. Traffic and the proportion of large trucks in this traffic are shown in Table 4.2.

*Table 4.1*
*THE FLEET AND FLEET CHARACTERISTICS*
*(CIRCA 1989)*

| Vehicles | Population | Average annual km | Annual VKT (billion) | Average GVW (tonnes) | Average RGVW (tonnes) | Average ESALs |
|---|---|---|---|---|---|---|
| Passenger cars | 10,249,054 | 17,380 | 178.1 | 1.0 | 1.0 | 0.00001 |
| Trucks | | | | | | |
| – small | 2,309,194 | 18,000 | 41.6 | 1.5 | 1.5 | 0.00007 |
| – large | 509,381 | 44,448 | 22.6 | 23.3 | 37.2 | 1.5 |
| Buses | 62,494 | 19,000 | 1.2 | 7.0 | 8.0 | 0.02 |
| Motorcycles, etc. | 377,997 | 3,700 | 1.4 | 0.2 | 0.2 | 0.0 |
| Other | 71,846 | 10,000 | 0.7 | 8.0 | 8.0 | 0.03 |
| | **13,579,966** | | **245.6** | | | |

**Source: Table A.1.**

*Table 4.2*
*TRAFFIC VOLUMES*
*(CIRCA 1987–1990)*

| Road class | AADT | % Trucks |
|---|---|---|
| Freeway | 12,000 | 15 |
| Paved (urban) | 4,000 | 7 |
| Paved (rural) | | |
| – busiest 10% | 6,000 | 13 |
| – medium-volume 30% | 3,000 | 7 |
| – low-volume 60% | 700 | 7 |
| Surface-treated | 350 | 7 |
| Gravel | 50 | 7 |
| Earth | 10 | 7 |

# 5. PAVEMENT ECONOMICS

## 5.1 INTRODUCTION

This section extends the discussion in Section 2 by considering pavement costs. Illustrative examples are developed using Ontario costs for construction and resurfacing and the OPAC model described previously. Since conditions in other parts of the country are different, the results may not be fully applicable to the whole country.

The following questions were examined:

- Given the choices made when designing a pavement — the most important one being the decision on the initial pavement life — how do pavement costs behave?
- What portion of pavement costs vary with the number of LEFs?
- Are TAC's unit costs for maintenance, resurfacing and reconstruction reasonable?
- Can the adjusted TAC costs be further adjusted so as to produce a more "optimal" road cost (that is, optimal with respect to initial pavement life or durability)?

## 5.2 MAINTENANCE COSTS

"Maintenance" means routine maintenance or expenditures not considered as capital expenditures. This differs from usage in other studies where maintenance includes such activity as resurfacing.

TAC's information indicates that, in total, maintenance accounts for $1.8 billion in annual expenditures and that the national average amounts to anywhere from $3,663 to $10,355 per two-lane equivalent kilometre, depending on the class of road. More information is given in Table 5.1. The point to note is how much these costs vary from one jurisdiction to another.

Maintenance costs, apparently, do vary enormously from one jurisdiction to another.[5] For example, in four provinces where detailed information has been obtained, snow and ice control varies from a low of $613 per two-lane kilometre per year to a high of $5,097. (Snow and ice are easy items to deal with as there is little confusion about how these factors are recorded in different accounts.) In view of this variability, TAC's costs for maintenance are not adjusted (other than the minor corrections discussed in Section 3).

There are, though, the issues discussed in Section 2 to resolve: Are maintenance activities a function of initial pavement life? Are maintenance activities a function of traffic? What portion of maintenance is related to pavements? No answers to these questions have been found. The best that can be offered is a preliminary analysis (Appendix C) which suggests that the pavement-related portion of maintenance might be in the range of 6 to 20 percent. A figure of 15 percent is used in this study as a guess at the national average.

*Table 5.1*
*TAC'S DATA ON MAINTENANCE COSTS PER KILOMETRE*
*(1989 $)*

| Road class | Average | Highest value | Lowest value |
|---|---|---|---|
| Freeway | 10,356 | 14,050 | 3,270 |
| Paved (urban) | 4,554 | 10,600 | 2,663 |
| Paved (rural) | 7,743 | 12,350 | 2,900 |
| Surface-treated | 5,086 | 7,000 | 0 |
| Gravel | 4,509 | 12,000 | 0 |
| Earth | 3,663 | 5,300 | 1,580 |

**Source:** **RTAC Lotus files, as adjusted.**

## 5.3 RESURFACING COSTS

TAC's information suggests that resurfacing costs amount to $1.5 billion a year, this being a function of unit costs — which vary from zero in the case of earth roads to $90,385 per two-lane kilometre in the case of freeways — and the duration of the overlay. In TAC's data, this second item is unrealistically variable. Hence, in Section 3 these costs were adjusted downwards to a level of $0.7 billion, but even this amount is based on leaving any of TAC's duration figures of between 5 and 25 years in place. More information on the original TAC data is shown in Table 5.2. (These are the unit costs of resurfacing, not the average annual costs.)

*Table 5.2*
*TAC's Data on Resurfacing Costs Per Kilometre*
*(1989 $)*

| **Road class** | **Average** | **Highest value** | **Lowest value** |
|---|---|---|---|
| Freeway | 90,385 | 170,000 | 0 |
| Paved (urban) | 71,436 | 80,000 | 60,000 |
| Paved (rural) | 72,852 | 120,000 | 0 |
| Surface-treated | 9,840 | 63,900 | 0 |
| Gravel | 4,437 | 18,000 | 0 |
| Earth | 0 | 0 | 0 |

To calculate pavement costs in the illustrations which follow, typical Ontario overlay costs are used based on a thickness of between 50 mm for light traffic to 90 mm for heavy traffic. The life of the overlay is assumed to be 12 years. (Overlay costs shown apply only to roads with flexible asphalt pavements. The costs of resurfacing other roads in TAC's data are not known. Further, as has been described in Section 3, it is not clear how many provinces actually resurface surface-treated or gravel roads.) The typical Ontario overlay costs, then, are as follows:

| Annual ESALs | Overlay costs (two-lane km) |
|---|---|
| 250,000 | $55,000 |
| 1,000,000 | $65,000 |
| 2,000,000 | $75,000 |

While conditions and costs vary from province to province, it is difficult to accept the highest numbers in TAC's data. Part of the reason, both for the variability among provinces and the general level of TAC's costs, is explained in the following passage:

> The roadway manager generally will attempt to hold other restoration activities until the resurfacing must be done. This includes such activities as curb renewal, widening of shoulders, intersection improvements and so on. Several contracts were analyzed to determine the percentage these items represented of the basic cost of resurfacing. The average was found to be 15%. Unit costs for resurfacing include these percentages. (RTAC, 1987b, pp. 15-16)

In other words, TAC's information is not *just* for the costs of keeping existing roads in place in perpetuity. It also includes improvements to the quality of the roads. To construct an optimal cost for this study, any of TAC's figures lying within plus or minus 20 percent of the Ontario figures given above are used. No adjustments are made to TAC's figures for surface-treated, gravel and earth roads.

| | Optimal resurfacing costs and duration (per two-lane km) | | Accepted TAC values (per two-lane km) | |
|---|---|---|---|---|
| | $ | years | $ | years |
| Freeways | 65,000 | 12 | 52,000–78,000 | 9–14 |
| Paved (rural) | 55,000 | 12 | 44,000–66,000 | 9–14 |

## 5.4 CONSTRUCTION OR RECONSTRUCTION COSTS

TAC's information on reconstruction suggests a total annual amount of $1.3 billion. National average unit costs vary from a low of $7,483 for earth roads to a high of $522,482 for freeways on a two-lane equivalent basis. The variability among the provinces is much greater than this as shown, in part, in Table 5.3. No significant adjustments were made to these costs in Section 3. As with TAC's figures on resurfacing though, there is a suspicion that "reconstruction" involves more than just reconstructing pavements. Although none of TAC's background documents provide any explanation, conversations with a member of the RTAC committee which developed the numbers indicate that "reconstruction," in the case of some (perhaps all) provinces, was taken to mean both the reconstruction of the pavement and any required improvements. "Reconstruction," it was explained, "could involve changes to the road alignment and/or the vertical geometry." For this reason, then, the figures in Table 5.3 have to be seen as something more than just the cost of maintaining Canada's road network *in their current state* indefinitely.

*Table 5.3*
*TAC'S DATA ON RECONSTRUCTION COSTS PER KILOMETRE*
*(1989 $)*

| Road class | Average | Highest value | Lowest value |
|---|---|---|---|
| Freeway | 522,482 | 1,000,000 | 200,000 |
| Paved (urban) | 401,152 | 550,000 | 234,300 |
| Paved (rural) | 303,325 | 430,000 | 100,000 |
| Surface-treated | 167,280 | 430,000 | 0 |
| Gravel | 22,504 | 106,500 | 0 |
| Earth | 7,483 | 17,483 | 0 |

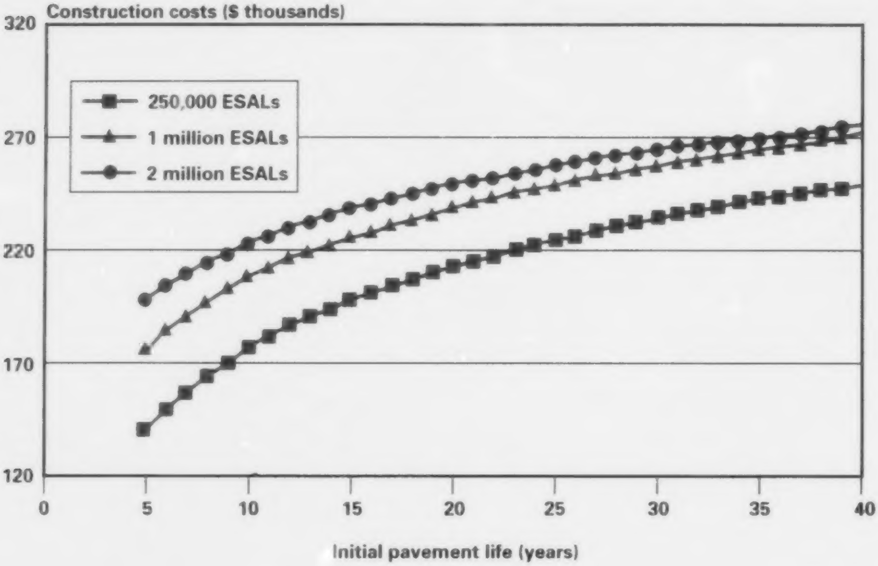
To analyze construction costs, the OPAC model described in Section 2 was used along with the following costs:

| | |
|---|---|
| Surface course | $950/mm/two-lane-km |
| Base and sub-base courses | $200/mm/two-lane-km |

Figure 5.1 shows construction costs as a function of initial pavement life for three levels of annual axle loads. In looking along any individual curve, it is evident that moderate increases in costs add many years to initial pavement life. Second, in considering the distance between the curves, it is evident that moderate increases in costs add enormously to the number of ESALs a pavement can accommodate. These vertical distances show the economies of scale described previously. For example, with a pavement life of 15 years, costs are $197,079 for 250,000 ESALs and $237,587 for two million ESALs — a 21 percent increase in costs for an eight-fold increase in load-carrying ability.

*Figure 5.1*

CONSTRUCTION COSTS AS A FUNCTION OF INITIAL PAVEMENT LIFE



Without considering (yet) the portion of deterioration caused by the environment, the average total-cost-per-ESAL curves in Figure 5.2 also demonstrate something about construction costs. Averages have been calculated as the construction costs shown in Figure 5.1 divided by annual ESALs times the number of years of initial pavement life. As shown, average costs — without accounting for environmental deterioration — decrease as the initial pavement life is extended, and as traffic loadings increase. The lowest total average cost per ESAL, then, is found on a road with heavy truck traffic built with a pavement designed to last a long time.

Another point to note about construction costs is shown in Figure 5.3 where costs for two design lives vary with annual ESALs. The data from which this is generated are based on slightly different costs per millimetre than the information used in other graphs. It can be seen that, after a certain point, the curves are relatively flat. This demonstrates the same point as that illustrated by the vertical distance between the curves in Figure 5.1: small additional amounts spent on construction accommodate large increases in loadings. Second, the division between load- and environment-related deterioration can be more or less "read" off this graph. In the absence of any axle loads, a pavement with a 15-year initial life has a cost of $70,000. For a 20-year life, the cost is $94,000 with no traffic loadings. Moving to the right on the graph, all the additional costs are attributable to load. So, for example, at 250,000 ESAL [illegible] the 15-year curve, costs are $149,000. At this point about half of the construction costs arise because of load-related factors, and the other half because of environmental factors.

There are qualifications, though. First, the precise values of $70,000 and $94,000 are not fixed. That is, for the illustrations used in this report, a number of values for typical construction costs per millimetre were used and, as a result, the curves in Figure 5.3 move up and down somewhat. Second, the above discussion makes it appear as if the environmental and load-related costs of construction are independent. As discussed in Section 2, while the OPAC model does separate the two, load and environment work together in causing deterioration.

*Figure 5.2*
CONSTRUCTION COSTS PER ESAL

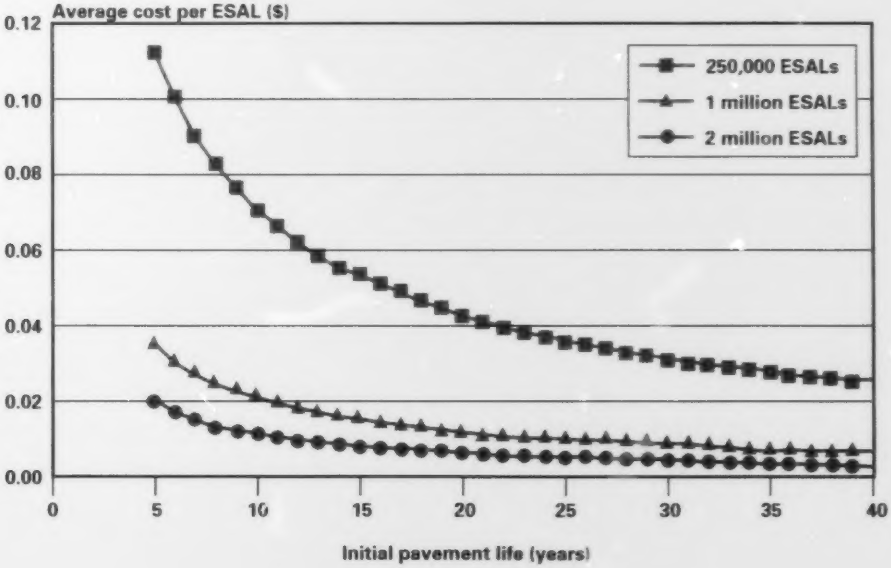
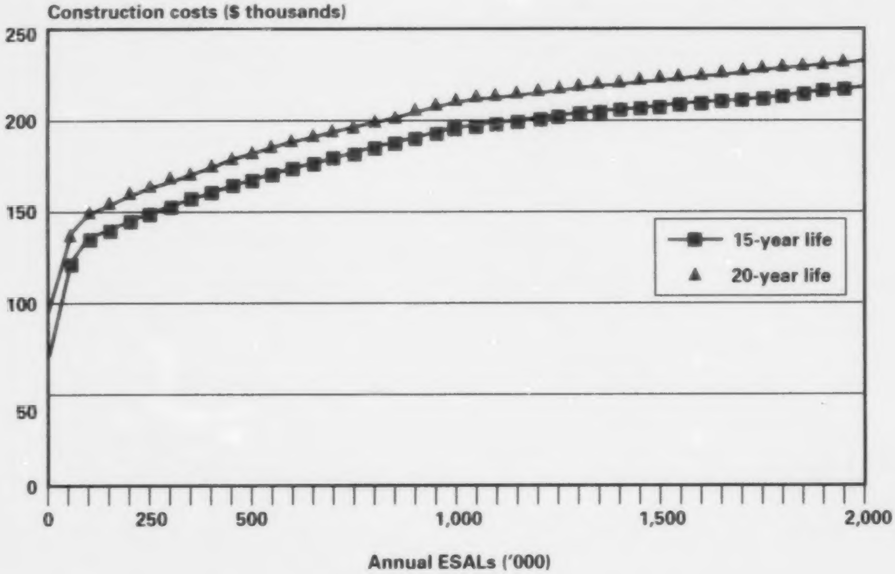


*Figure 5.3*

*Construction Costs as a Function of ESALs*



## 5.5 MINIMUM LIFE-CYCLE COSTS

In Canada, it is normal in pavement design strategy to minimize initial pavement construction costs, pavement resurfacing costs, and delay costs to traffic created by resurfacing and reconstruction operations. The following discussion of minimum life-cycle costs, however, does not include the third item — delay costs.

The terminology used is:

$C$ = construction costs per two-lane kilometre
$R$ = resurfacing costs per two-lane kilometre
$M$ = annual maintenance costs per two-lane kilometre
$N$ = time horizon
$n_1$ = initial pavement life (that is, the period during which RCI declines from 8.5 to 4.5)

$n_2$ = overlay #1 life, assumed to be 12
$n_3$ = overlay #2 life, assumed to be 12
$r$ = discount rate

The first way of looking at the problem is as follows:

$$\text{Total cost} = C + \frac{R}{(1+r)^{n_1}} + \frac{R}{(1+r)^{(n_1+n_2)}} + M \times \left[\frac{(1+r)^N - 1}{r(1+r)^N}\right]$$

The last term, the present value of annual maintenance costs, does not affect the analysis and, therefore, is ignored. In Figure 5.4, cost curves — that is, the present value of construction and resurfacing costs — for three levels of annual ESALs are shown using a discount rate of 5 percent. The curves for the higher annual axle loadings are quite flat, suggesting that the choice of an initial pavement life is not critical. For example, in the case of two million ESALs, there is only a 2.2 percent difference between the highest and lowest cost. The curve for 250,000 annual ESALs does rise continuously, suggesting that the optimum strategy may be to build pavements with short lives for low-volume roads.

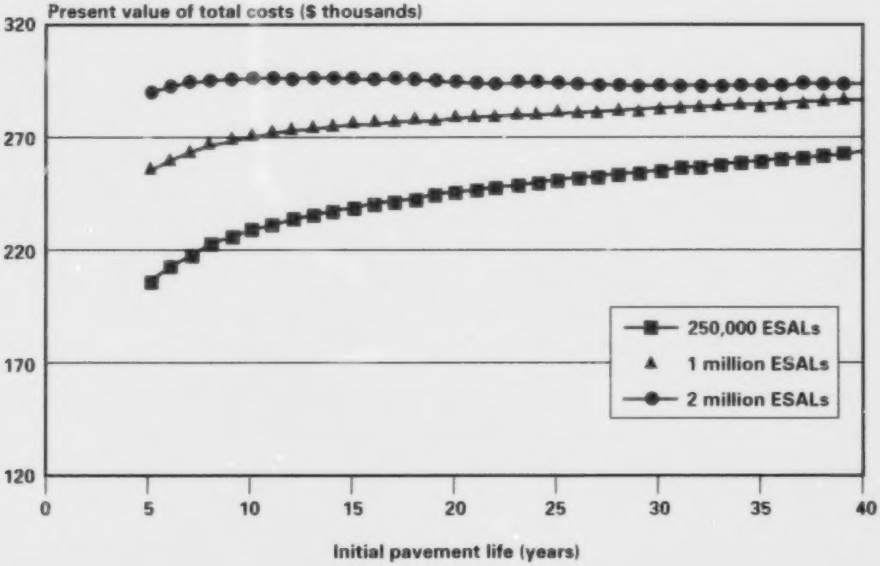
For a high ESAL load, increased construction costs of thicker and thicker pavements are just about offset by the savings in the present value of resurfacing costs. That is, longer initial pavement lives "push" resurfacing time further into the future and the effect is about equal to the increase in initial costs. For low-volume roads (low annual ESALs), construction costs rise more rapidly as initial pavement life is extended, and the offsetting advantage of delaying resurfacing expenditures is less important. (In the previous Figure 5.1, the 250,000 ESAL curve has a steeper slope than the other two.)

The discount rate affects the analysis and, in Figure 5.5, the three curves are recalculated using 10 percent.[6] The slopes are all slightly steeper, although in the case of two million ESALs the difference between the highest and lowest cost is still relatively small (7 percent).

*Figure 5.4*

*PRESENT VALUE OF LIFE-CYCLE COSTS (1)*

*(R = 5%)*

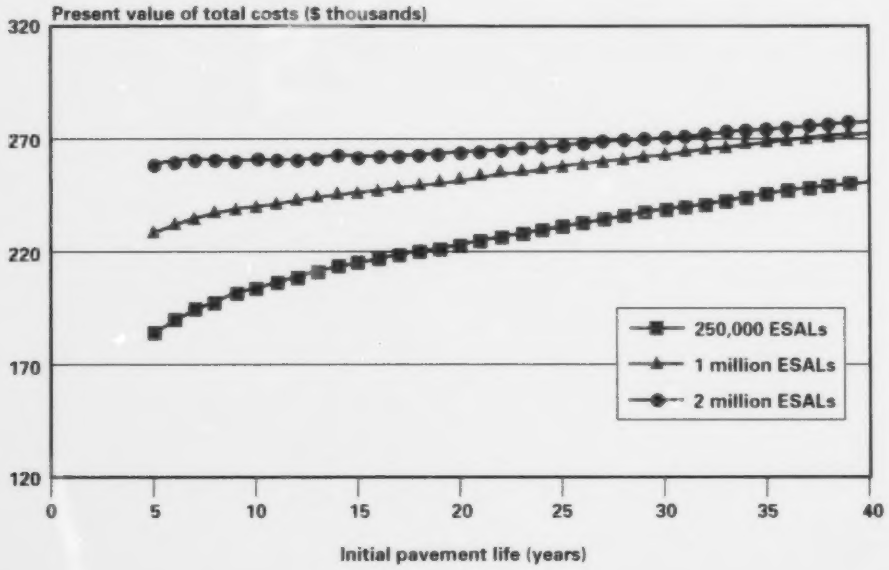


In case one pavement cycle is not a sufficiently long time period in which to analyze optimum pavement lives, the curves in Figures 5.6 and 5.7 show what happens when two cycles are included. In other words, these are based on:

- current construction costs;
- resurfacing costs $n_1$ years and $n_1 + n_2$ years in the future;
- reconstruction costs $n_1 + n_2 + n_3$ years in the future;
- resurfacing costs $n_1 + n_2 + n_3 + n_1$ and $n_1 + n_2 + n_3 + n_1 + n_2$ years in the future.

*Figure 5.5*

PRESENT VALUE OF LIFE-CYCLE COSTS (2)
(R = 10%)



As shown in Figures 5.6 and 5.7, the curves are much flatter when two pavement cycles are included in the analysis. With a discount rate of 5 percent, the 250,000 ESAL curve rises initially and, at 17 years, gradually declines. The one million ESAL curve is almost flat with only a 5-percent difference between the highest and lowest point. In the case of two million ESALs, costs fall slowly throughout the entire range: costs at a 40-year initial pavement are 11 percent lower than with a five-year initial pavement life. Again, an increase in the discount rate "tilts" all the curves back up to the right.

A qualification to this analysis concerns delay costs. Their inclusion has the effect of giving all of these curves a more negative slope. In other words, deferred resurfacing costs *along with* deferred delay costs increasingly outweighs the additional construction costs for pavements with longer initial lives. This does not, however, quite resolve the issue of the optimum pavement life. Aspects of pavement performance are poorly understood. A difference of perhaps 10 to 15 percent in total life-cycle costs may not mean much for an asset whose life can vary by 50 percent or more because of a variety of factors — variations in construction quality, short-run changes in traffic, variations in material properties — which are not yet included in performance models.

The conclusion that emerges from this analysis is that, for the purpose of developing costing procedures for Canadian roads, there is no evidence that pavements are being built with less than optimum durability. Any initial pavement life of about 15 years or more seems to be optimal in terms of minimizing total life-cycle costs. For the busiest roads, in terms of axle loads, an optimum pavement life may be somewhat longer than 15 years (particularly if delay costs are considered). For the lowest-volume roads, there may even be some reason to consider pavement lives of less than 15 years.[7]

*Figure 5.6*

*PRESENT VALUE OF LIFE-CYCLE COSTS (3)*

*(R = 5%)*

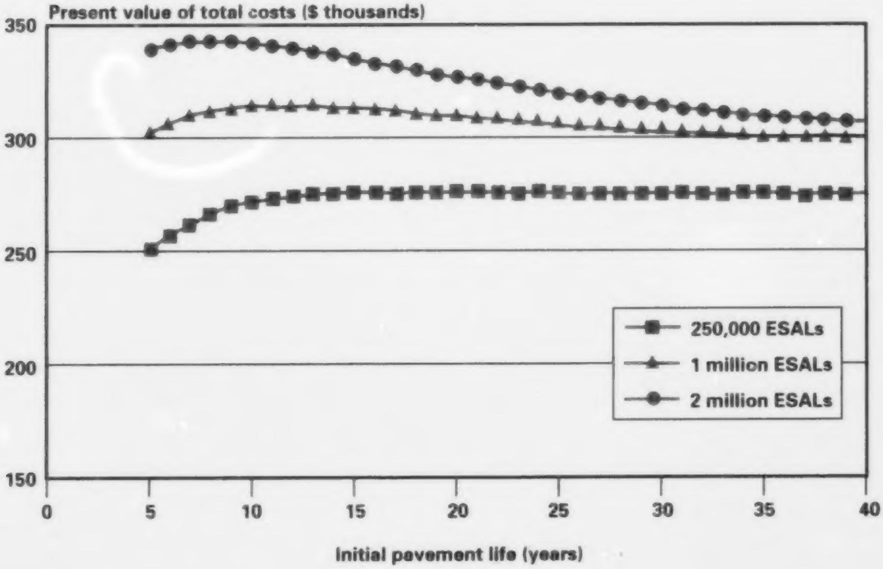
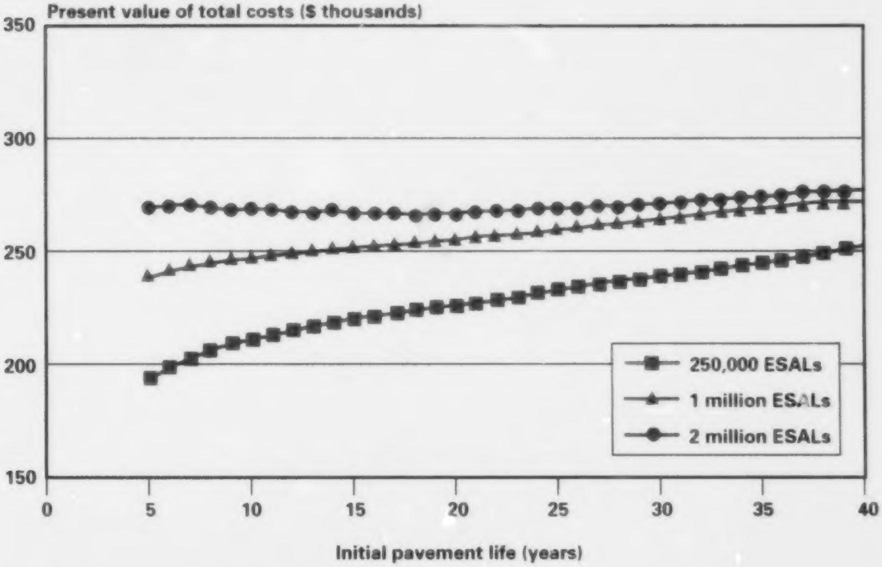


Figure 5.7
PRESENT VALUE OF LIFE-CYCLE COSTS (4)
(R = 10%)



## 5.6 OPTIMAL ROAD COSTS

For the purpose of costing in Section 7, two sets of TAC costs are used: "adjusted" as described in Section 3, and "optimal" (ignoring any consideration of demand) as developed in this section.

*Maintenance:* These are the same as the adjusted costs described in Section 3. For the purpose of calculating the costs that vary with usage, it is assumed that 15 percent are pavement related.

*Resurfacing:* These are as described in subsection 5.3. That is, for freeways, any TAC numbers between $52,000 and $78,000 and a duration of between 9 and 14 years remain unchanged. Other values are set at $65,000 and 12 years. For other paved roads, rural or urban, any TAC numbers between $44,000 and $66,000 with a duration of 9 to 14 years remain unchanged.

Other values are changed to $55,000 and 12 years. TAC's figures for the remaining three classes of roads are not changed (except for the adjustments described in Section 3).

*Reconstruction:* Given the analysis in the preceding section, these are the figures used for optimal TAC costs:

| | Optimal reconstruction costs and duration (per two-lane km) | | Accepted TAC values (per two-lane km) | |
|---|---|---|---|---|
| | $ | years | $ | years |
| Freeways | 225,000 | 45 | 180,000–270,000 | 40–50 |
| Paved (rural) | 200,000 | 45 | 160,000–240,000 | 40–50 |

Reconstruction costs in TAC's data for other roads are not changed.

The newly calculated optimal TAC costs are shown in Tables 5.4 to 5.6. Administration costs have been adjusted downwards since they are calculated as 4.1 percent of all other costs.

Table 5.4

OPTIMAL TOTAL MAINTENANCE AND PAVEMENT COSTS

(TOTAL ANNUAL COSTS, MILLIONS OF 1989 $)

| Road class | Maintenance | Resurfacing | Reconstruction | Total |
|---|---|---|---|---|
| Freeway | 139.2 | 73.6 | 61.0 | 273.8 |
| Paved (urban) | 5.5 | 5.9 | 6.4 | 17.9 |
| Paved (rural) | 1,005.5 | 582.5 | 551.0 | 2,139.0 |
| Surface-treated | 167.7 | 42.1 | 165.0 | 374.7 |
| Gravel | 494.3 | 35.2 | 110.7 | 640.2 |
| Earth | 18.0 | 0.0 | 1.8 | 19.8 |
| | **1,830.1** | **739.3** | **895.9** | **3,465.3** |

*Table 5.5*

OPTIMAL AVERAGE MAINTENANCE AND PAVEMENT COSTS

(ANNUAL COSTS PER TWO-LANE KILOMETRE, 1989 $)

| Road class | Maintenance | Resurfacing | Reconstruction | Total |
|---|---|---|---|---|
| Freeway | 10,355 | 5,475 | 4,538 | 20,368 |
| Paved (urban) | 4,554 | 4,916 | 5,301 | 14,772 |
| Paved (rural) | 7,743 | 4,486 | 4,244 | 16,472 |
| Surface-treated | 5,086 | 1,276 | 5,003 | 11,365 |
| Gravel | 4,509 | 321 | 1,010 | 5,840 |
| Earth | 3,663 | 0 | 374 | 4,037 |

*Table 5.6*

OPTIMAL TAC ROAD COSTS: SUMMARY

(MILLIONS OF 1989 $)

| | | |
|---|---|---|
| Annual maintenance | | $1,830.1 |
| Pavement | | |
| - resurfacing | $739.3 | |
| - reconstruction | 895.9 | |
| - total | | 1,635.2 |
| Bridges | | 296.3 |
| Administration | | 154.2 |
| **Total** | | **$3,915.8** |

## 6. COSTING METHODOLOGIES

### 6.1 INTRODUCTION

To an economist, "the cost of an event is the highest-valued opportunity necessarily forsaken." (Alchian, 1977, p. 301). The purpose of the cost concept is to enable choices to be made among available options. This did not raise many difficulties as long as traditional economic analysis concentrated on single-product firms. But, in reality, many production processes yield more than one product. The question then becomes one of knowing how to allocate the costs of a common input among joint outputs.

If, for example, an airplane carries passengers and freight, what portion of the costs of gasoline, labour and facilities should be attributed to each? The airline itself does not have to make this allocation of common costs; its interest is in ensuring that the total cost of the whole set of joint products is less than the total revenue from their sale. To maximize revenues, it has to ensure that the marginal revenue from the sale of each of the joint products equals or exceeds the marginal cost of their production. Market prices will be those instruments which allocate the amount produced among the competing consumers and yield a maximum wealth to the producer. In other words, pricing and output decisions can be made even though common costs cannot be assigned.

This normative argument which is based on the role of rationing by market prices explains why economists have long considered certain cost allocations unnecessary and possibly misleading. For instance, Stigler warns that "any allocation of common costs to the product is irrational if it affects the amount of the product produced, for the firm should produce the product if its price is at least equal to its minimum marginal costs." (Stigler, 1966, p. 165).

But many situations, internal as well as external to the activities of the firm, generate needs to allocate common costs and, therefore, to develop practices which are consistent with the required use. Consider, for example, accounting rules and/or tax regulations. These may require firms to allocate joint costs. Or, consider a firm's efforts for internal efficiency. In effect, in large firms it may be necessary to allocate costs to set internal prices. The computer division of a company, for example, may "charge" other divisions for computer time. The objective of allocating costs is to ensure the cooperation of different managers in maximizing joint profits. Large firms, therefore, need cost allocations to define and design managerial incentive and reward structures when decentralized decision making prevails.

Regulation is an example of where actions external to a firm give rise to the need for cost allocation. The regulator, acting as an alternative to the market pricing mechanism, needs information on how common costs should be allocated among different products if the actual economic forces at work are to be changed or modified.

The case of a public road, however, is different from a private firm which may allocate costs for internal or external reasons. Here there is a complete dissociation between the way the product is offered (the service of the road according to the principle of first come, first served) and the manner in which fees are collected (registration fees and fuel taxes prepaid before consuming the output of the road). To understand the role of cost allocation in this context, consider the characteristics of the industry:

- Revenues from users (that is, those levies in Canada which have traditionally been considered "road-user taxes") are not tied to road expenditures. (With one or two minor exceptions, this is generally true in Canada.) This raises the issue, then, of the role of cost allocation under a system which does not use explicit road prices and which does not link any tax with road expenditures.
- There are economic indivisibilities in building roads (that is, investment is "lumpy") which means — in considering an individual road — there are economies of scale. This has traditionally been used to identify a natural monopoly. The issue becomes one of setting prices and of relating these prices to various notions of cost in a situation where there are increasing returns to scale.
- An individual road has a given capacity. In places where traffic volumes approach this limit, cost-allocation studies attempt to measure a capacity cost. But, in places where traffic volumes are less than the capacity of the road — a situation which characterizes most Canadian roads — roads are a pure public good. "As long as there is neither wear nor congestion, the services of the road should be free since they are pure social goods." (Walters, 1968, p. 20).

A road, however, is only one part of a network. This further complicates the allocation of costs and the relationship of these costs to user-charges. Some have envisaged the network as an industry producing two services: car travel or traffic capabilities and truck travel or load-bearing capabilities. The question is whether each production occurs under constant returns to scale or not. There is agreement with respect to the load-bearing capability of pavements: there are sharply increasing returns to scale (see Sections 2 and 5). But, in the case of traffic output, there is no consensus. Some suggest that capacity increases faster than the number of lanes. Others argue that the need for, and cost of, intersections grows faster than road width and, further, that the cost of the land in dense urban areas favour the decreasing returns to scale argument.

A second question, following from the first, is whether or not there are economies of scope. Diseconomies of scope exist if the cost of producing traffic volume and traffic axle-loadings jointly is more than the cost of separate production. The essential idea here is captured in the following: "the wider the road is made in order to accommodate more cars, the greater the cost of any additional thickness required to handle a heavy vehicle, because all the lanes must be built to the same thickness." (Small, Winston and Evans, 1989, p. 102).

Many of these arguments (and questions), however, are unnecessary in the context of Canadian roads, the vast majority of which operate at less than capacity volumes. This point is not obvious to those who spend their time on the few sections of the network around major urban areas which are congested, or those who travel on some interurban highways on a July weekend. Nevertheless, it remains true — see the rough estimates of AADTs[8] in Section 4 — and the implication is that an optimal road user-charge will not recover the full cost of the road network. The underlying assumption of any Canadian costing study, therefore, should be that there are increasing returns to scale and, further, that a marginal cost pricing scheme will not produce revenues equal to road expenditures.

## 6.2 APPLICATIONS

Theoretical foundations aside, there are four commonly recognized costing methods in use. These follow the terminology of the Trucking Research Institute in the United States. (The Urban Institute, Sydec, Inc., 1990)

*The incremental method:* Used in the 1956 federal study in the United States, this is based on the concept of avoidable costs: if a cost can be avoided because a particular vehicle class is excluded, then this cost is properly attributable to that class. In effect, the methodology recognizes a base road and associated cost which is assigned to all vehicles. Pavement costs are assigned to all vehicles in proportion to axle-miles and other costs (bridges, grading) in proportion to vehicle-miles. Costs for features of the road not included in the base system are assigned to larger and heavier vehicles.

*The federal method:* Also developed in the United States in the 1982 FHWA study, this method has been further generalized in Australia and the United Kingdom. Although similar in its basic philosophy to the incremental approach, the two methods differ in the way they allocate pavement costs and bridge replacement and repair costs. The first major difference lies in the definition of a minimum pavement and the use of ESALs for allocating pavement costs over and above this minimum. The incremental method benefits users with heavy axles as, in effect, they capture all of the benefits of the economies of scale inherent to pavement strength production. The use of ESALs in the federal method assigns these costs equally to all vehicles in proportion to their responsibility for ESALs. Secondly, under the federal method, expenditures for rehabilitation and replacement which were not taken into consideration under the incremental method, are based on distress models which simulate the consumption of pavements. Finally, rather than allocating bridge replacement and repair costs in proportion to the allocation for new bridges as the incremental method does, the federal method uses a bridge replacement function.

*The benefits-based method:* This assigns cost responsibility across road user classes in proportion to some measure of differential benefits derived from highway expenditures. It is a variant of the benefit theory of taxation holding that people should be taxed according to benefits received from government expenditures. The underlying principle is to reproduce, in the public sector, the one-to-one relationship which exists in a market economy between benefits received and opportunity costs incurred. To allocate benefits, however, consistent information on operating costs, travel time costs and accident costs of road users is required. This is difficult to find. In any case, most have rejected the benefits method as it is at odds with the efficiency goals of public policy.

*The marginal cost method:* Often advocated by economists but rarely used in practice, this method holds that users should pay the marginal social cost of using the road network. Until recently the required procedures for allocating costs in this manner were not well developed. The 1982 FHWA study made an attempt at such an approach in one of its appendices (U.S. FHWA, 1982, Appendix E). More recently, Newbery (1988a, 1988b) and Small, Winston and Evans (1989) have presented theoretical frameworks and applied the results, respectively, to the United Kingdom and the United States. In general, the marginal cost method considers two categories of cost: the private cost of road use and the social road-use costs. The first category includes the vehicle operating costs and the cost of the operator's time. The second category includes costs borne by third parties: highway agency costs, pollution costs, road damage costs (that is, the passage of a candidate vehicle raises the costs of subsequent vehicles by, for example, making the pavement rougher) and congestion costs. There is disagreement as to whether the correct cost is a short- or a long-run one.

The underlying philosophy of these four approaches is different. The first three are based on equity principles, whereas the last one is essentially efficiency-oriented. More specifically, among the equity methods, the first two put the emphasis on the use of costs as an allocation device and the third puts the emphasis on benefits received. The incremental and federal methods attempt to determine equitable cost allocations among various user classes according to a cost-occasioned standard. Although the benefits-based method shares the same equitable principle, it proceeds by allocating benefits to highway user classes rather than costs. Finally, the marginal cost method, which searches to promote economic efficiency is not constrained by having to consider road expenditures as total costs.[9] The basic principle is that each trip should be priced at its marginal social cost. This marginal cost pricing rule, then, does not involve allocations of costs among users. For this reason, it is similar to the situation encountered by a multi-product firm where the only concern is that marginal revenues equal or exceed marginal costs.

## 6.3 COSTING STUDIES

### 6.3.1 1982 FHWA Study

One of the more widely emulated cost-allocation studies was undertaken in the early 1980s in the United States. In it, capital expenditures are separated into three categories: pavement, bridges and other. There are no annual (that is, non-capitalized) costs included. Pavement costs consist of new pavements, either rigid or flexible, and pavement rehabilitation which consists of resurfacing, restoration, rehabilitation and reconstruction ("4-R" costs). The main elements of bridge costs are new bridges, replacement bridges and bridge repairs. The third "other" category consists of right-of-way, grading, and other miscellaneous capital costs such as administration, planning, and preliminary engineering.

New pavement costs are assigned in a two-step procedure: the costs of minimum pavement thickness are treated as common costs and allocated on the basis of vehicle-miles of travel (VMT), and the costs of extra pavement thickness are based on the relative consumption or damage of pavements by vehicle classes and are allocated on the basis of ESALs. Pavement 4-R costs are assigned to each vehicle class according to distress models and the relative importance of each type of distress. The distress models take into account the interaction of the environment and the repetitive passage of ESALs.

New bridge costs are allocated on the basis of the incremental strength method; that is, over and above a certain minimum strength, additional costs are assigned on the basis of GVW. Bridge repair costs are treated as a residual, and the costs of replacement bridges have a special set of relationships to vehicle characteristics.

The third or "other" category consists of grading and drainage costs which are first allocated on the basis of vehicle weight-to-horsepower ratios; and lane-width costs which are first allocated on the basis of width characteristics of vehicle classes. As a second step, all of these costs are translated into costs per VMT.

These three capital costs are allocated to three highway classes: interstate highways, other arterials and collectors, and local roads and streets. Further, these three highway classes are costed in either rural or urban settings. In Table 6.1, a summary is shown of the distribution of costs among two vehicle classes by allocation factor. In total, the FHWA approach assigns 59.9 percent of costs to passenger vehicles and the remaining 41.1 percent to trucks. Most of the passenger vehicles share of costs can be explained by its responsibility for the residual factor (VMT) whereas most of the trucks share of costs can be explained by its responsibility for ESALs.

*Table 6.1*
*FHWA DISTRIBUTION OF HIGHWAY COSTS*
*(CARS VERSUS TRUCKS, BY ATTRIBUTABLE VERSUS RESIDUAL FACTORS)*

| | | **Allocation Factor** | |
|---|---|---|---|
| **Vehicle class** | **Total costs** | **Attributable (ESALs)** | **Residual (VMT)** |
| Passenger vehicles | 59.9% | 16.7% | 42.2% |
| Trucks | 41.1% | 36.6% | 4.5% |

**Source: U.S. FHWA, 1982, p. I-9.**

### 6.3.2 U.K. Cost Study

The U.K. allocation of costs is more complete than the 1982 FHWA allocation as it estimates expenditures by both central and local government. It then attributes these among users according to many factors. Expenditures include capital and maintenance road costs, and policing and traffic warden costs. The FHWA study only dealt with the first of these. The U.K. procedure uses five allocation factors: maximum gross vehicle weight (max GVW), passenger car units (PCU), travel distance (VKT), average laden gross vehicle weight (av GVW), and standard axle loads (indicated here as LEFs). Most are multiplied by the total kilometres for each vehicle class (av GVW-km). Four road classes are recognized, including what would be considered "local" or "municipal" roads in Canada.

Capital expenditures are allocated to vehicle classes in a two-step procedure: the first resulting in 15 percent of costs allocated to vehicles over 1.525 tonnes in tare weight, with the allocating factor being max GVW-km; and the second resulting in the remaining 85 percent of costs being allocated to all vehicles according to their PCU-km. The allocation of maintenance costs (which has a broader meaning than in TAC's data) is "based on expert advice from highway engineers and research scientists" (U.K. DoT, 1990-91, p. 1). The allocation factors are VKT, av GVW-km, and ESAL-km. As with all allocations, there are arbitrary aspects to these U.K. procedures.

Table 6.2 shows the result of the U.K. method for fiscal year 1990-91. Overall, 67.7% of the costs are allocated to passenger vehicles (cars and buses), 23.6% to trucks and 8.7% to pedestrians — the main component of the "other" user class. The use of incremental procedures results in most capital costs being assigned to passenger vehicles as they account for most travel (84.7% of the PCU-km), with much of the balance being assigned to trucks as they account for most of the weight (85.7% of the max GVW-km). Current expenditures, on the other hand, are allocated primarily to passenger vehicles as, again, they account for most of the travel (VKT) and a large proportion of the actual weight on the roads (av GVW-km). The major portion of current expenditures allocated to trucks arises because of their responsibility for most of the axle loads.

Table 6.2

**U.K. DoT Distribution of Highway Costs**

**(Vehicle Classes, Allocation Factors, 1990-91)**

| | | Capital | | | Current | | | |
|---|---|---|---|---|---|---|---|---|
| **Vehicle class** | **Total** | **PCU-km** | **max GVW-km** | **Total** | **Vehicle-km** | **av GVW-km** | **LEF-km** | **Total** |
| Cars | 67.7% | 84.7% | 12.3% | 73.8% | 94.2% | 69.0% | 13.3% | 55.6% |
| Trucks | 23.6% | 13.7% | 85.7% | 24.5% | 4.3% | 29.4% | 85.9% | 36.4% |
| Other (incl. pedestrians) | 8.7% | 1.6% | 2.0% | 1.7% | 1.5% | 1.6% | 0.8% | 8.0% |

### 6.3.3 Australian Study

As in the U.K. research, the Australian study's estimates of road costs "are based on the allocation of all the financial costs incurred by road authorities in the provision of road infrastructure, in road maintenance, and in the supervision of road use." (Australia, Inter-State Commission, 1990, p. 78). The procedure distinguishes two types of expenditures: separable, or those which can be reasonably associated with the use of the road; and non-separable, or those which are common to all users. The allocating factors for separable expenditures are VKT, PCE-km, max GVM-km, and LEF-km. The factor for non-separable costs is VKT. The number of vehicles is also used as an allocation factor for "miscellaneous" expenditures.

All arterial roads — national highways, national and local roads — are considered. Table 6.3 shows the results for two vehicle classes by the allocation factor in 1989-90. As shown, 68.9% of the costs are assigned to passenger vehicles and 31.1% to trucks. Road costs are allocated to passenger vehicles primarily because of their responsibility for total travel (91.4% of VKT and 81.7% of PCE-km). The share of costs allocated to trucks arises because of their responsibility for axle loads (96.1% of total LEF-km) and the total weight on the road (77.4% of total maximum GVW-km).

Table 6.3

AUSTRALIAN DISTRIBUTION OF ROAD COSTS

(BY VEHICLE CLASS, BY ALLOCATION FACTOR, 1989-90)

| Vehicle class | Total costs | Costs allocated by: | | | | |
|---|---|---|---|---|---|---|
| | | VKT | PCE-km | LEF-km | Max GVW-km | # Vehicles |
| Passenger | 68.9% | 91.4% | 81.7% | 3.9% | 22.6% | 95.9% |
| Truck | 31.1% | 8.6% | 18.3% | 96.1% | 77.4% | 4.1% |

The study considers other costs associated with road use, namely, accidents, congestion, noise and atmospheric pollution. However the estimates for these are not included in the global figures. The authors also mention an issue raised by the World Bank: the effect of environmental factors on road deterioration (Paterson, 1987). However, after raising some concerns about the specification and interpretation of Paterson's model, they conclude that their non-separable cost estimates compare well with Paterson's guidelines.

### 6.3.4 Haritos' Study

The only Canadian research is Haritos' monograph for the Canadian Transport Commission in 1973[10] updated, in part, with the use of RTAC data in 1989 (Nix, 1989). The methodology draws heavily on the incremental method from the first federal study in the U.S. Road expenditures included are: capital (including land), maintenance and policing and justice costs. Capital costs are divided between escapable (those which vary with usage) and inescapable (those which do not vary with usage) according to one of two assumptions: either all capital costs are inescapable or else two thirds of capital costs are inescapable. Similarly, maintenance is classified into escapable and inescapable categories. In this case, though, the separation is made on the basis of a lengthy analysis of specific items contained within a maintenance account and some guesswork as to how these vary with usage. Costs, both capital and maintenance, are then allocated to vehicles on either an annual basis (inescapable) or on a trip basis (escapable) according to a complicated series of what essentially are arbitrary assignments. The most important aspects of these are developed directly from the incremental method. The end result is a comparison of annual road revenues (making assumptions about what constitutes a road tax) and these elaborate assignments of costs. The findings and the methodology are dated by now and there is not much purpose served in describing them here.

### 6.3.5 Marginal Cost Studies

Economists argue that roads should be viewed as a valuable and scarce resource and, therefore, their use should be rationed by the price mechanism. In the particular context of a road which is characterized not only by the private costs of road use, but also by externalities such as congestion, pollution, road damage and accidents, an efficient price implies that road users should pay the marginal social cost of using the road network, regardless of the particular trip undertaken.

*The 1982 FHWA study:* an early application of the concept of a short-run marginal cost (SRMC) to roads is found in the 1982 FHWA study. Costs are calculated in a two-step procedure. First, private costs of road use paid by owners are computed: fuel, wear and tear, driver's time and so forth. Second, the social costs arising from vehicles using roads and borne by third parties are calculated.

The first of these social costs is pavement wear which is subdivided into two distinctive parts: pavement repair costs borne by the road agency and road damage costs borne by road users. Both are a function of axle loads. Environment and soil conditions are recognized for their potential effect on pavement deterioration, but are not taken into account for technical considerations. The portion of pavement wear borne by users arises because rougher pavements increase vehicle operating costs.

The second social cost is the cost of congestion which is subdivided into three parts: the decrease in speed below free-flow levels, implying additional travel time; the increase in operating costs resulting from these delays; and the increase in the frequency of accidents. The first two parts are computed by using linear volume-delay functions whereas accident costs, though known to be important, are not incorporated because of an absence of good estimates.

The third social cost is air, water and noise pollution arising from vehicle use. Air and noise pollution costs are computed; however, water pollution costs are not because of insufficient evidence on how to estimate efficient prices.

The final result of these computations gives an idea of what an efficient user-charge system may be (see Table 6.4). They depend on the vehicle used, the location, the congestion (measured as a "volume-to-capacity" or *V/C* ratio) and the road class.

*Table 6.4*

### FHWA EFFICIENT USER-CHARGES (U.S. 1981 CENTS PER VMT)

| Vehicle type | Location | Key parameter | Road-use costs | Congestion costs | Pollution costs | Total |
|---|---|---|---|---|---|---|
| Auto – 3,000 lb (1.4 tonne) | Rural | $V/C$ = .05 | 0.3 | 0.3 | 0 | 0.6 |
| Auto – 3,000 lb (1.4 tonne) | Urban | $V/C$ = .85 | 0.7 | 11.2 | 1.6 | 13.5 |
| Truck 3-axle – 40,000 lb (18 tonne) | Small urban | $V/C$ = .35<br>PCE = 1.2<br>ESAL = 0.8 | 33.6 | 2.2 | 0.4 | 36.2 |
| Truck 5-axle – 72,000 lb (33 tonne) | Urban interstate | $V/C$ = .15<br>PCE = 1.2<br>ESAL = 1.6 | 40.6 | 1.4 | 7.0 | 49.0 |
| Truck 3-axle – 60,000 lb (27 tonne) | Urban collector or rural | $V/C$ = .25<br>PCE = 2.0<br>ESAL = 4.0 | 244.5 | 3.1 | 12.0 | 259.6 |
| Truck 4-axle – 100,000 lb (45 tonne) | Rural arterial | $V/C$ = .05<br>PCE = 3.0<br>ESAL = 27.2 | 503.5 | 0.3 | 0.2 | 504.0 |
| Truck 9-axle – 105,000 lb (48 tonne) | Rural interstate | $V/C$ = .15<br>PCE = 3.0<br>ESAL = 1.0 | 9.0 | 1.2 | 0.1 | 10.3 |

**Source: U.S., FHWA, 1982, pp. E-53 and E-54.**

*Small, Winston & Evans:* a second application of a marginal pricing technique was undertaken by Small, Winston and Evans (1989). Their proposal is general in that they integrate two economic principles: the first, an efficient pricing system to regulate demand for highway services, and the second, an efficient investment policy to minimize the total public and private cost of providing them. They compute a congestion cost for an urban expressway and a principal urban arterial respectively as a cost-per-peak-period PCE-mile. It varies from 14.5 to 15.1 cents (U.S.). They also compute the marginal cost of road wear on the basis of their model of pavement deterioration described in Section 2. This varies from 0.2 to 4.0 cents per ESAL-mile. These costs, both congestion and road wear, are only calculated for urban expressways and urban arterial roads.

*Newbery:* Newbery promotes the idea that road users should pay the true social cost of transport (Newbery, 1990, 1988a and 1988b). His main contribution to the debate lies in his road damage externality theorem which states that: "If the age distribution of roads of a given type is constant, and the traffic flow is constant, and all road damage is attributable to traffic, then the average road damage cost of a vehicle is identically equal to the average maintenance cost allocated in proportion to its number of equivalent standard axles. The road damage externality is zero." (Newbery, 1988b, p. 305). Subsequent users' costs are raised by the transit of a heavy vehicle (the cost raising effect) whereas the resulting road damage also brings forward the date of road repair (the cost reducing effect). Newbery's theorem shows these two effects approximately balance each other. Therefore, when considering road damage costs, only the pavement cost which reflects the increased cost of repairing the roads, and which is borne by the highway authority has to be considered.[11]

Newbery also considers congestion costs. By using statistical results from different British researchers, he computes a short-run marginal congestion cost (MCC) which varies by road classes (motorway, truck, principal and other), by period of time (peak and off-peak) and by vehicle types. This measure is expressed in pence per PCE-km. Table 6.5, taken from Newbery (1990, p. 29), presents some results for the United Kingdom for 1990.

*Table 6.5*

MARGINAL CONGESTION COSTS IN GREAT BRITAIN, 1990

| | MCC pence/PCE-km | Index of MCC |
|---|---|---|
| Motorway | 0.26 | 8 |
| Urban central peak | 36.37 | 1070 |
| Urban central off-peak | 29.23 | 860 |
| Non-central peak | 15.86 | 466 |
| Non-central off-peak | 8.74 | 257 |
| Small town peak | 6.89 | 203 |
| Small town off-peak | 4.20 | 124 |
| Other urban | 0.19 | 6 |
| Other rural | 0.05 | 1 |
| Weighted average | 3.40 | 100 |

**Source: Newbery, 1990, p. 29.**

Newbery also looks at accident costs in an aggregate manner, without relating them to road classes and vehicle categories. Pollution costs are only mentioned.

*Vitaliano & Held:* the most recent contribution on marginal costs is from Vitaliano and Held (1990), but they examine only one of the costs included in an efficient pricing mechanism: road damage. Using a sample of 457 road segments in the State of New York, they estimate the road damage marginal cost generated by the cumulative numbers of ESALs passing over a given road surface. The management of this road network is characterized by a damage-sensitive maintenance strategy. That is, as is also the case in Canada, roads are resurfaced when a measure of serviceability (roughness) reaches a certain point. Moreover, they attribute 50 percent of pavement deterioration to the environment. Their estimate of a user-charge per ESAL-mile varies from 1.15 cents (U.S.) for rural and urban interstates to 28 cents for rural collectors. For a five-axle tractor-trailer weighing 80,000 lb, pavement wear costs per mile vary from 3 cents when driving on rural and urban interstates to 74.2 cents when running on rural collectors.

# 7. COSTING

## 7.1 INTRODUCTION

There are numerous ways to develop costs for Canadian roads: Which methodology should be used? What TAC data or what modifications to TAC data should be included? What assumptions should be made about traffic and vehicles? And what adjustments should be made in light of the analysis of pavements in Section 2? This section explores the possibilities. A cautionary note: all calculations could benefit from firmer data on construction costs, vehicles and vehicle characteristics.

In subsection 7.2, the FHWA, the U.K., and the Australian methodologies are used with both the adjusted and the optimal TAC data on costs. In subsection 7.3 an exploratory cost allocation is described which combines the best information from TAC with the information in Sections 2 and 5, along with features of the other allocation studies. In subsection 7.4 an attempt is made to calculate marginal pavement costs for existing roads.

## 7.2 FHWA, U.K. AND AUSTRALIAN METHODS

A summary of TAC's costs allocated according to the methods of other allocation studies is shown in Tables 7.1 and 7.2, with details in Appendix D. Observations are:

- TAC's maintenance and administrative expenditures are not incorporated into the FHWA method. If administration expenditures had been "loaded" onto other costs, the costs would be 4.1 percent higher than those shown. The main feature of the FHWA method shown in Tables 7.1 and 7.2 is the treatment of existing pavement costs. The only way of replicating this complex part of the FHWA method is to use one of the FHWA tables showing the final distribution of costs to various vehicle classes. This, however, introduces errors as the vehicle classes used do not match those available from Canadian data. Further, it is likely that the distribution of vehicles among these imperfectly matched classes is different in the two countries. For these reasons, the numbers shown in Tables 7.1 and 7.2 under the FHWA method are not particularly meaningful.
- "Maintenance," as used in the U.K. DoT's method encompasses all expenditures found in TAC's data. The result is that none of the U.K. methods for treating what are referred to as "capital costs" is relevant. Capital costs for the U.K. DoT are expenditures for "new construction and improvements."
- The cost allocation in the U.K. method applies to a wider range of roads than those in TAC's data. As a result, some judgement has to be used in knowing how much of the U.K. methodology to borrow. For example, "pedestrians," as an allocation factor, have not been used in the numbers shown in Tables 7.1 and 7.2.
- Under the U.K. method, all resurfacing and reconstruction costs, and a portion of maintenance costs (as defined here) are allocated to vehicles on the basis of ESAL-kilometres. There is no recognition that pavement deterioration is caused by factors other than axle loads. The result, as is evident in the numbers shown in Tables 7.1 and 7.2, is that trucks are assigned a large proportion of total costs.

Table 7.1

### Cost Allocations, Adjusted TAC Data (1989 Can $)

| | FHWA method pavement & bridge costs only | | U.K. method | | Australian method | |
|---|---|---|---|---|---|---|
| | Total costs (millions) | Per km (cents) | Total costs (millions) | Per km (cents) | Total costs (millions) | Per km (cents) |
| Passenger cars | 521.4 | 0.5 | 1,130.4 | 1.0 | 2,175.5 | 2.0 |
| Small trucks | 408.5 | 1.5 | 296.7 | 1.1 | 548.8 | 2.0 |
| Large trucks | 1,309.8 | 7.5 | 2,876.8 | 16.5 | 1,567.4 | 9.0 |
| Buses | 47.7 | 6.0 | 14.6 | 1.8 | 17.8 | 2.3 |
| Motorcycles, etc. | 3.7 | 0.5 | 7.4 | 0.9 | 15.3 | 1.9 |
| Other | 41.3 | 10.5 | 8.1 | 2.1 | 9.2 | 2.3 |
| | **2,332.4** | | **4,334.0** | | **4,334.0** | |

Table 7.2

### Cost Allocations, Optimal TAC Data (1989 Can $)

| | FHWA method pavement & bridge costs only | | U.K. method | | Australian method | |
|---|---|---|---|---|---|---|
| | Total costs (millions) | Per km (cents) | Total costs (millions) | Per km (cents) | Total costs (millions) | Per km (cents) |
| Passenger cars | 459.7 | 0.4 | 1,118.7 | 1.0 | 2,050.6 | 1.9 |
| Small trucks | 338.3 | 1.2 | 293.8 | 1.1 | 517.5 | 1.9 |
| Large trucks | 1,058.4 | 6.1 | 2,474.6 | 14.2 | 1,308.6 | 7.5 |
| Buses | 38.6 | 4.9 | 14.2 | 1.8 | 16.8 | 2.1 |
| Motorcycles, etc. | 3.3 | 0.4 | 7.3 | 0.9 | 14.4 | 1.8 |
| Other | 33.3 | 8.4 | 7.8 | 2.0 | 8.7 | 2.2 |
| | **1,931.5** | | **3,916.6** | | **3,916.6** | |

- The Australian method applies to a wider variety of expenditures than those included in TAC's data. However, once the TAC accounts have been matched with the Australian accounts — a process which requires some judgement — the allocation procedure is relatively straightforward.
- Under the Australian method, at least the portion of the methodology which is applicable to TAC's data, non-separable costs — those which do not vary with usage — account for about two thirds of the total

(Appendix D, Table D.7). As these are allocated on the basis of VKT, the result is that automobiles are assigned a far higher proportion of costs than in the other methods.

## 7.3 AN EXPLORATORY ATTEMPT TO ALLOCATE TAC'S COSTS

Appendix E describes an exploratory allocation method. It is exploratory in the sense that more work is required on many of the underlying variables before much confidence could be had in the results. Although it is possible to test the sensitivity of the results against assumptions made about the questionable variables — for example, that the average truck in Canada generates 1.5 ESALs — such work has not been done.

The method starts with TAC's costs as described in Section 3. It then modifies these according to the information in Sections 2 and 5. Owing to the gaps in the knowledge about roads other than those with flexible pavements and owing to the insignificance of urban paved roads (in the network under consideration), only two classes of roads are considered: freeways and rural paved roads. In TAC's original numbers these two classes account for 76.6 percent of total maintenance and pavement costs (see Table 3.3). Rural paved roads, for this exploratory method, are separated into three categories according to the AADT estimates in Appendix A.

The results are shown in the accompanying tables, starting with unit costs on Table 7.3. Expenditures are allocated in the following manner:

- Administration costs, set at 4.12 percent of all other costs, are treated as a fixed cost and allocated on the basis of VKT.
- Bridge costs, following the example of the Australian study, are treated in two components: 58 percent are fixed and allocated with VKTs; 42 percent are a function of vehicle weight and allocated on the basis of the average weight of vehicles times the distance driven (GVW-km).
- TAC's maintenance costs for rural paved roads are altered slightly so that the busiest roads have a higher cost per kilometre than the least travelled roads (see Table 7.3). This is done to account for the fact that maintenance costs may be (partly) a function of traffic volumes. (The alterations do not change the average cost for all paved rural roads.)

The 15 percent of maintenance costs that are pavement related are added to other pavement costs.

Table 7.3

UNIT COSTS

(1989 $, TWO-LANE EQUIVALENT BASIS)

| Roads | Maintenance costs/km | Resurfacing costs/km | Reconstruction costs/km |
|---|---|---|---|
| Freeway | 10,355 | 65,000 | 225,000 |
| Paved (rural) | | | |
| – busiest 10% | 9,292 | 65,000 | 200,000 |
| – medium-volume 30% | 7,743 | 55,000 | 170,000 |
| – low-volume 60% | 7,485 | 55,000 | 160,000 |

- Pavement costs, which include resurfacing, reconstruction and a portion of maintenance, are a function of both axle loads and the environment. In this attempt to develop an allocation procedure, the proportion of deterioration attributable to environmental factors (*E*) has been set at:

| | *E* |
|---|---|
| freeways | 40% |
| busiest rural highways | 50% |
| medium-volume rural highways | 70% |
| low-volume rural highways | 80% |

Pavement costs are allocated as follows: cost times *E* is a fixed cost; cost times 1-*E* is a function of ESALs and allocated as an average cost per ESAL.

- Maintenance costs related to traffic, a further 15 percent of the total, are treated as variable and allocated to vehicles on the basis of distance driven (VKT).
- Maintenance costs which are not related to pavements and which are not a function of traffic — the remaining 70 percent — are treated as a fixed cost and allocated on the basis of VKT.

The result of these procedures is shown in Table 7.4. Since bridge and administration costs are treated on a system-wide basis, these amounts are not included.

### Table 7.4
### VARIABLE VERSUS FIXED COSTS
### (ANNUAL PAVEMENT AND MAINTENANCE COSTS PER TWO-LANE KILOMETRE)

| **Road class** | **Variable costs** | | **Fixed costs** |
|---|---|---|---|
| | **VKT** | **ESAL** | |
| Freeways | 1,553 | 6,393 | 11,511 |
| Paved (rural) | | | |
| - busiest 10% | 1,394 | 4,928 | 11,432 |
| - medium-volume 30% | 1,161 | 2,502 | 11,259 |
| - low-volume 60% | 1,123 | 1,609 | 11,676 |

From Table 7.4, the proportion of costs which are fixed on each class of road is:

| | Proportion of fixed costs |
|---|---|
| Freeways | 59.1% |
| Paved (rural) | |
| - busiest 10% | 64.4% |
| - medium-volume 30% | 75.4% |
| - low-volume 60% | 81.0% |

The costs per unit of output — arbitrarily dividing fixed costs by total kilometres of travel — are as shown in Table 7.5.

### Table 7.5
### COSTS PER UNIT OF OUTPUT

| **Road class** | **Variable costs** | | **Fixed costs $ per VKT** |
|---|---|---|---|
| | **$ per VKT** | **$ per ESAL-km** | |
| Freeways | 0.0004 | 0.0065 | 0.0026 |
| Paved (rural) | | | |
| - busiest 10% | 0.0005 | 0.0115 | 0.0052 |
| - medium-volume 30% | 0.0011 | 0.0217 | 0.0103 |
| - low-volume 60% | 0.0044 | 0.0599 | 0.0457 |

Administration costs for the whole network amount to $0.0009 per kilometre driven by all traffic. Bridge costs, again for the whole network, are $0.0002 per GVW-km plus the fixed cost of $0.0047 per kilometre.

Costs by vehicle and road class are shown in Table 7.6. These include system-wide bridge and administration costs. The multiplication of these costs and the VKT by vehicle class result in the following allocation of total annual costs:

| | | | |
|---|---|---|---|
| cars | $1,563.1 | million | 59.3% |
| small trucks | 393.7 | " | 14.9% |
| large trucks | 651.0 | " | 24.7% |
| buses | 12.1 | " | 0.5% |
| motorcycles, etc. | 10.7 | " | 0.4% |
| other | 6.2 | " | 0.2% |
| Total | $2,636.9 | million | 100.0% |

There is a further $1.03 billion representing either roads not dealt with here (gravel, etc.) or bridge and administration costs not assigned to the paved freeways and rural roads.

Table 7.6

COSTS BY VEHICLE AND ROAD CLASS

(ANNUAL CENTS PER KILOMETRE, 1989 CAN $)

| Road class | Cars | Small trucks | Large trucks | Buses | Motorcycles | Other |
|---|---|---|---|---|---|---|
| **Variable costs/km** | | | | | | |
| Freeways | 0.06 | 0.07 | 1.52 | 0.20 | 0.04 | 0.23 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.09 | 0.10 | 2.30 | 0.24 | 0.07 | 0.27 |
| – medium-volume 30% | 0.13 | 0.14 | 3.87 | 0.30 | 0.11 | 0.35 |
| – low-volume 60% | 0.46 | 0.47 | 9.93 | 0.71 | 0.44 | 0.79 |
| **Fixed costs/km** | | | | | | |
| Freeways | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 |
| – medium-volume 30% | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 |
| – low-volume 60% | 4.77 | 4.77 | 4.77 | 4.77 | 4.77 | 4.77 |
| **Total costs/km** | | | | | | |
| Freeways | 0.53 | 0.53 | 1.98 | 0.67 | 0.50 | 0.69 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.81 | 0.82 | 3.03 | 0.96 | 0.79 | 1.00 |
| – medium-volume 30% | 1.36 | 1.37 | 5.10 | 1.53 | 1.34 | 1.58 |
| – low-volume 60% | 5.23 | 5.24 | 14.70 | 5.48 | 5.21 | 5.57 |

While this methodology attempts to incorporate the best data from Appendix A, the best information available about pavement performance in the Canadian context, and the best features of other allocation studies, *more work* is required in testing and refining these procedures before they would be suitable for making any conclusions about policy.[12]

## 7.4 MARGINAL COSTS

In Appendix F, the steps required to estimate marginal costs are described. Again, the results are tentative. They represent *only* the marginal pavement costs of paved roads using the results of the OPAC model and typical Southern Ontario construction costs. Extending these results to all Canadian roads may not be appropriate.

This caveat aside, the process for estimating marginal pavement costs is relatively simple. From the OPAC model described in Section 2 and the construction costs described in Section 5 (Figure 5.3), a series of costs are developed for roads built to withstand a given number of annual ESALs. Initial pavement and overlay lives are assumed to be 15 and 12 years respectively. Further, overlay costs are assumed to increase for roads built for more traffic (axle loads) as described in subsection 5.3 for typical Ontario conditions. Using this information, the following cost curve (total life-cycle costs of pavements) is estimated:

$$C = 89{,}969 + 23{,}214 \times \log(\text{ESALs})$$

Marginal costs are estimated from the cost function as shown in Figure 7.1. For roads built for 250,000, one million and two million ESALs annually, marginal pavement costs are 4.0 cents, 1.0 cent and 0.5 cents respectively. To put these amounts in perspective, total marginal costs per kilometre for three trucks are shown in Table 7.7. The first truck is a heavily loaded three-axle truck typical of those used in the construction industry in Eastern Canada. The second, the five-axle tractor-semitrailer, is the most common large truck configuration in Canada. For the sake of this illustration, it is shown at the practical maximum weight for cross-Canada operations (some provinces allow higher weights). The last configuration shown is an eight-axle B-train, the largest truck in Canada except for those operating under special permit. It is used to haul heavy, bulk commodities. For this illustration, it is shown at the highest practical weight for cross-Canada operations.

Figure 7.1

MARGINAL PAVEMENT COSTS

($ PER ESAL-KM)

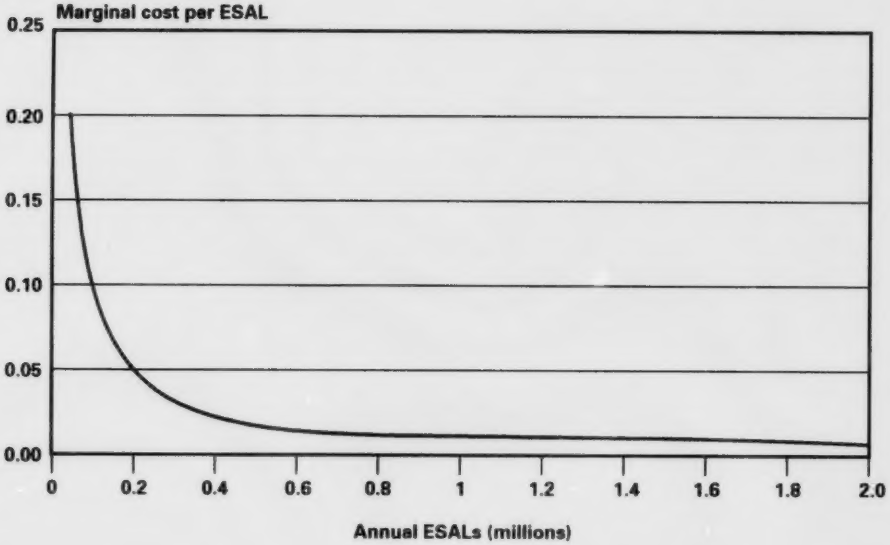


Table 7.7

MARGINAL PAVEMENT COSTS

(CENTS PER KILOMETRE)

| | LEFs | Low-volume road | Mid-volume road | High-volume road |
|---|---|---|---|---|
| 3-axle truck<br>25 tonne | a | 10.3 | 2.6 | 1.3 |
| | b | 15.0 | 3.8 | 1.9 |
| | c | 19.5 | 4.9 | 2.4 |
| 5-axle tractor-semi<br>39 tonne | a | 13.5 | 3.4 | 1.7 |
| | b | 18.4 | 4.6 | 2.3 |
| | c | 23.4 | 5.8 | 2.9 |
| 8-axle B-train<br>62 tonne | a | 18.6 | 4.6 | 2.3 |
| | b | 25.5 | 6.4 | 3.2 |
| | c | 33.1 | 8.3 | 4.1 |

The calculation of costs in Table 7.7 is based on three different load equivalency factors: (a) ESALs developed from AASHTO; (b) Canadian measurements developed from data collected in the Canroads study; and (c) the reinterpretation of the Canroads data at the University of Waterloo. These different load equivalency factors are used to demonstrate the point that the attempt to develop road costs is highly dependent on a number of engineering measures. They are only illustrations of this point, however, as it is not clear that it is appropriate to use marginal costs developed from a pavement deterioration model calibrated in AASHTO's ESALs to determine the pavement costs of a particular truck where load equivalencies are calculated in a different manner.

A final way of putting these marginal costs into perspective is to consider the traffic data described in Appendix A. These suggest the following annual average ESALs for different segments of Canada's rural highway network:

| Rural highways | Annual ESALs | Annual ESALs per lane | Marginal pavement costs per ESAL-km |
|---|---|---|---|
| busiest 10% | 427,475 | 213,737 | 4.7 cents |
| medium-volume 30% | 115,189 | 57,594 | 17.5 cents |
| low-volume 60% | 26,877 | 13,439 | 75.0 cents |

These have to be viewed in the context of all the qualifications about the traffic data in Appendix A and the assumptions used to estimate the proportion of truck traffic and the average ESALs per truck. Better data are clearly desirable. Even without these, however, the broad observation can be made that marginal pavement costs rise very rapidly for lower-volume roads. Further, for a large number of Canadian roads, these marginal costs may be quite high. *May be,* as there is uncertainty at the low end of the range — that is, annual ESALs as low as 13,439 — as to whether the pavement performance underlying the OPAC model is appropriate. It may well be that the Alberta model is more appropriate for estimating marginal costs for these lower-volume roads. This possibility has not been investigated.

# 8. CONCLUSIONS

The findings of this research can be summarized in the following 15 observations:

1. *Major research objectives:* In terms of the major objective — the calculation of road costs for vehicles in various classes — the work has demonstrated that there are a number of ways of estimating road wear costs. TAC data, substantially modified, along with estimates of vehicles and their characteristics may be combined with any one of several allocation methodologies to produce the required numbers. As an alternative, estimates about the relationship between axle loads and pavement costs can be made and marginal pavement costs calculated. Other aspects of road costs — capacity, users, externalities — have not been investigated.
2. *Qualifications:* This finding that road costs can, and have been estimated, must be qualified. These qualifications are related to four aspects of the procedures described in this report: the appropriateness of the methods used to calculate costs; the quality of the numbers used in the calculations; the extent of the federal, provincial, territorial road network covered; and, finally, the adequacy of the knowledge about roads (primarily pavement performance).
3. *FHWA method:* As to the appropriateness of the various methods, there are practical problems applying FHWA's methodology to TAC's data. First, the FHWA methodology is only appropriate for capital expenditures. Second, the FHWA method of handling existing pavement costs (distress models) is not something that can be done by simply "borrowing" the findings from its work to apply to someone else's road expenditure numbers. For these reasons, the numbers calculated here and shown in Section 7 are not too meaningful.
4. *The U.K. method:* Similarly, it is doubtful that the U.K. method applied to TAC's data results in a credible allocation of costs. For one thing, the U.K. method applies to a larger class of roads and a broader range of expenditures than those considered here. This means that aspects of the methodology have to be applied selectively. The more significant problem with the U.K. method, however, is that it attributes all pavement costs to axle loads. There is no recognition of the deterioration caused by environmental factors.

5. *The Australian method:* The application of the Australian method to TAC's data suffers from some of the same problems encountered with the U.K. method: different classes of roads and broader expenditures considered than those available in TAC's data. However, once a linkage is made between the Australian and TAC expenditure categories, this method is the most appealing of the three considered for Canadian conditions as it treats pavement costs in two components: a portion varying with axle loads, and a fixed portion that does not vary with traffic.

6. *Other allocation methods:* Other allocation methods have been briefly discussed in the report (the "incremental method," Haritos' method which draws on the incremental method, and benefit-based methods). For reasons discussed, however, none is appropriate for use in a modern Canadian cost-allocation study.

7. *Exploratory method:* Drawing on the best features of the various allocation methods described in Section 6, the best features of the adjusted TAC data, and the features of roads described in Section 2, an exploratory allocation method has been presented in Section 7.3. If a cost-allocation study is required in Canada, this method has something to offer. However, the numbers actually calculated are deliberately labelled "exploratory" to indicate that more work is required before the results could be used to influence transportation policy.

8. *Marginal pavement costs:* Allocation studies by their very nature are somewhat arbitrary. The calculation of marginal costs, on the other hand, can be more precise. Further, from the perspective of economics, marginal costs have the advantage of being theoretically sound as they are a prerequisite for efficiency-based policies. In this research, a tentative marginal pavement cost function has been estimated. It suggests that marginal pavement costs range from about 4.0 cents per ESAL-kilometre on low-volume roads to 0.5 cents on high-volume roads. Here, "low" and "high" volume are used as they were in the analysis of pavements using Ontario's OPAC model: 250,000 annual ESALs at the low end and two million ESALs at the high end.

9. *Marginal pavement costs and Canadian roads:* Considering the actual axle loadings on much of Canada's rural highway network, "low volume" may mean considerably less than 250,000 annual ESALs. The data examined in Appendix A suggest that much of the network may

have less than 20,000 annual ESALs. If this is true, marginal pavement costs may be as high as 75 cents per ESAL-kilometre or as high as $3.75 per kilometre for some of the heavier trucks. However, the suitability of extending the OPAC model, used to develop the estimate of marginal pavement costs, and the typical Ontario construction costs to these low-volume roads is not known. Other models of pavement deterioration, such as the one used in Alberta, may be more appropriate. The relative significance of environmental factors in these models may actually mean that marginal pavement costs per ESAL are lower than this figure of 75 cents. None of these possibilities has been tested.

10. *Quality of data:* The second major qualification about the costs estimated concerns the quality of the data used. For the allocation procedures, data had to be developed on the number of vehicles using the roads and the characteristics of these vehicles. The figures assembled here (Appendix A) are adequate for a discussion of allocation studies, *but they do not compare with* the accuracy and level of detail required for a cost-allocation study in the order of those reviewed in Section 6. For the discussion of pavements, pavement economics and marginal pavement costs, the data used here are of an illustrative rather than empirical nature.

11. *Extent of the road network covered:* The third major qualification about the costs estimated concerns the road classes for which costs were computed. Although the allocation procedures described in Section 7 show costs allocated for surface-treated, gravel and earth roads, the procedure of "borrowing" a methodology from somewhere else and extending it to these roads is not sound. In terms of the marginal costs estimated, these are only done for roads with flexible pavements. To this extent, then, this research has not been successful in determining the road costs of vehicles on a large segment (about one half) of the federal, provincial and territorial roads. Admittedly, these roads account for a very small portion of total travel: the figures calculated in Appendix A suggest they account for 2.5 percent of all — urban and interurban — travel in Canada.

12. *Knowledge about roads:* Costing, whether an allocation procedure or the estimation of marginal costs, cannot be undertaken without an understanding of the physical nature of roads. Repeatedly, in this research, questions arose about the underlying causal factors at work when considering one methodology or another. Why and how do

pavements deteriorate? What is the appropriate axle load equivalency factor? Do maintenance activities vary with traffic volumes? And so on. Indeed, at a time when most of the pavement research community is tied up in the largest pavement performance research effort ever undertaken (SHRP), analysts attempting a costing exercise must be prepared to modify their procedures in light of new findings which may emerge. For example, recent work on pavements in Canada even suggests that the number of large trucks has nothing to do with pavement deterioration (Papagiannakis et al.). While this seems unlikely, it does demonstrate the difficulty of finding good empirical measures for pavement performance which, of course, are a prerequisite for good costing procedures. As another example, consider the problems associated with load equivalencies. The three LEFs used in this research can sometimes result in marginal pavement costs for a large truck that differ by a factor of two. Which is the appropriate one to use given that the available pavement performance models are based on one measure, and that the best available Canadian empirical data produce the other measures?

13. *The "Under Built" thesis:* In the United States, an argument has been made that pavement deterioration models are based on a mis-specified relationship between axle loads and pavement lives. The result, the authors of this argument suggest, is that pavements have been built with less than optimal durability. If this also were true in Canada, the implications for a costing study would be that pavement costs should be estimated by using higher initial construction costs than those implicit in TAC's (adjusted) data. However, no evidence can be found that this "under built" thesis is valid in Canada. First, most of the pavements in Canada are flexible pavements and a large part of the argument in the United States concerns rigid pavements. Second, the model of pavement deterioration most applicable to Canadian conditions for areas such as Southern Ontario (the OPAC model), when combined with typical construction costs, suggests that the optimal pavement cost is not particularly sensitive to the choice of initial pavement life. For these reasons, the determination of road-user costs in Canada does not have to be adjusted for any recognition that pavements have been built with less than optimal durability.

14. *The "Under Maintained" thesis:* Another question raised recently, which would also have implications for the calculation of road-user costs, is this: "Are governments spending enough on the roads to

prevent unnecessary and costly deterioration?" An argument has been made in Canada for the past several years that governments are falling behind in the amount they spend on roads. The consequence, the argument goes, is that, in the long run, taxpayers will have to foot the bill for an expensive rehabilitation program. This is a complex argument which this research could not address fully. It may be that a road left to deteriorate will cost more in the long run than a road which is well maintained throughout its lifetime. This research has not investigated such a possibility. What it has investigated, however, is how well the "infrastructure-is-crumbling" thesis is based on facts. After adjusting for problems in TAC's data — the apparent adding mistakes and the failure to distinguish between *preserving* and *preserving and upgrading* roads — the calculations made here suggest that the annual expenditures required to maintain existing roads are in the neighbourhood of $4 billion. This is just about the amount governments are spending. The conclusion, therefore, is that the data do not support the idea that roads are falling apart because of insufficient spending. This conclusion has nothing to do with a related argument heard in Canada recently: governments should spend more on roads to increase capacity.

15. *Axle load versus environmental impacts on pavements:* One of the questions asked in the terms of reference was the relative contribution to pavement deterioration of traffic loads and of time (that is, the environment). The answer has great importance for any costing exercise as it largely determines the share of pavement costs attributed to large trucks. In some studies, most pavement costs are allocated to large trucks as these vehicles account for almost all of the heavy axles. In other studies, the argument is made that, for *rigid pavements,* the existence of environmental deterioration is minimal, if it exists at all. These other cost-allocation studies may be correct (little is known about the pavements for which they allocate costs), and the arguments made in respect of rigid pavements may be correct (they have not been investigated). However, according to the best evidence available in Canada, for flexible pavements and particularly for roads where the total annual axle loadings are relatively modest, *environmental factors account, by far, for the largest portion of pavement deterioration.* This suggests, then, that for most Canadian roads the environment, not axle loads,

is of most consequence in developing any costing procedures. Even on a very high-volume road, say one with two million ESALs per year, environmental factors may account for as much as 50 percent of the pavement deterioration. On low-volume roads, environmental factors may account for 80 percent or more of the deterioration.

## ENDNOTES

This report has been written by the authors under contract to the Royal Commission on National Passenger Transportation. Mr. Nix was the project director and in this role took prime responsibility for the development of the data and the writing of the report. Dr. Hutchinson was responsible for all engineering matters and, in particular, developed most of the material in Section 2 and some of the concepts in Section 5. Professor Boucher was responsible for all costing matters and, in particular, developed Section 6, parts of Section 7 and the related appendices.

The authors would like to thank the Transportation Association of Canada for allowing them access to its files for information on the Canadian road network. Thanks are also in order to Royal Commission staff for assembling a large amount of information from the provinces and to John Lawson in particular who reviewed four or five versions of this document and who made helpful suggestions.

The authors are responsible for any errors that may have crept into the analysis and are also responsible for the views expressed.

1. In TAC's estimate, "expenditure needs," the total for all federal and provincial roads is $5.1 billion. Of this amount, pavements account for $2.8 billion or 54 percent (see Section 3).

2. With the current AASHTO equivalency factors, the exponent is actually closer to 3.8 than 4.0 and the ESAL of a 10,000 kg single axle on a typical flexible pavement would be more like 2.20 than the 2.25 mentioned in the text.

3. This has been confirmed in discussions with TAC. Something happened between the time the information was taken from the Lotus file and the latest booklet was published. Whatever the problem, the assurance has been given by TAC that "the spreadsheet numbers are the correct ones."

4. The only change made is one minor instance where a province is shown to reconstruct paved rural roads every 10 years. This has been changed to 20 which results in such a minor change to the overall results that the average frequency of 47.3 years remains unaffected.

5. This is on the basis of several conversations with provincial highway people about the nature of TAC's data.

6. It is understood that Treasury Board recommends a discount rate of 10 percent.

7. There is another qualification. Because RCI declines over time at an increasing rate, the "quality" of the road surface may improve with increasing initial pavement life in the sense that there will be more years with high RCI ratings. If this is true, the "output" on any given cost curve in Figures 5.4 to 5.7 is not constant.

8. Road capacity cannot be inferred directly from measures of *average* AADT as the critical variables are the number of vehicles using a particular section of the road during the peak hour. However, if the typical rural highway can handle 1,500 to 2,000 vehicles per hour *per lane*, it seems likely that AADT figures *on a two-lane basis* in the range of 750 to 3,000 are considerably below the capacity of most road sections.

9. In the 1982 FHWA report it is noted that annual user-charge revenues obtained by the marginal social cost method would have resulted in $80 billion when overall spending for highway purposes was about $41 billion. For 1981, total highway user-charge receipts were an estimated $23 billion. For the United Kingdom, Newbery (1988a) computes an overall amount of road taxes equal to £9,760 million whereas the Department of Transport estimates road costs to equal £3,468 million.

10. Other cost-allocation studies have been done. For example, M. Bunting has made some calculations for Ontario; B. Bisson, and others at the University of New Brunswick, have written several relevant papers. Haritos, however, is the only one who attempted a national study.

11. It is not clear that Newbery's theorem is relevant to Canada given that environmental factors are responsible for so much of the pavement deterioration.

12. The question has been raised as to how the opportunity cost of capital is treated in the exploratory methodology. The answer is that, because the method deals with annualized costs, no capital is included. That is, there is no investment, no depreciation, and no (potential) rate of return. It is conceivable that a way of converting TAC's data into information that could generate these amounts might be developed (Haritos used provincial annual expenditures to estimate a capital stock). Such a process has not been attempted.

# APPENDIX A: VEHICLE AND TRAFFIC DATA

## A.1 THE FLEET

In 1989 there were 16.7 million vehicles in Canada, 12.8 million of these being passenger cars (Statistics Canada, Catalogue No. 53-219, p. 14). Combining these figures with other information results in the profile of the vehicle fleet shown in Table A.1. The adjustments shown in column 3 are based on the following:

*Number of large trucks:* In 1987 Statistics Canada shows roughly one million trucks registered in Ontario (No. 53-219). Ontario registration statistics for 1987 show that there were 150,474 registered trucks with a GVW of 4.5 tonnes or greater (Nix, 1990, p. 5). Extrapolating this to the rest of the country, it is estimated that 85 percent of the truck fleet consists of small pickups and vans typically used by tradespersons and often used as a substitute for passenger cars. The remaining 15 percent are classified as "large" trucks.[1]

*Number of cars and small trucks:* The population of cars and small trucks is thought to be considerably smaller than as indicated by the registration statistics. Reasons for this are unknown and, in any case, are unimportant. The best information available suggests that perhaps 80 percent of the registered vehicles actually exist and are in use at any given time.[2]

*Table A.1*
*THE FLEET AND FLEET CHARACTERISTICS*
*(TOTAL VEHICLES, BY TYPE)*

| 1 Vehicles | 2 Registrations 1989 | 3 Assumed distribution | 4 Average annual distance | 5 Annual VKT (million) | 6 Average GVW (tonnes) | 7 Average RGVW (tonnes) |
|---|---|---|---|---|---|---|
| Passenger cars | 12,811,318 | 10,249,054 | 17,380 | 178,129 | 1.0 | 1.0 |
| Trucks | 3,395,874 | | | | | |
| – small | | 2,309,194 | 18,000 | 41,565 | 1.5 | 1.5 |
| – large | | 509,381 | 44,448 | 22,641 | 23.3 | 37.2 |
| Buses | 62,494 | 62,494 | 19,000 | 1,187 | 7.0 | 8.0 |
| Motorcycles, etc. | 377,997 | 377,997 | 3,700 | 1,398 | 0.2 | 0.2 |
| Other | 71,846 | 71,846 | 10,000 | 718 | 8.0 | 8.0 |
| | **16,719,529** | **13,579,966** | | **245,639** | | |

**Source: Statistics Canada, Catalogue No. 53-219 and estimates.**

## A.2 AVERAGE WEIGHT

Information in Table A.1 on average weights, either GVW or RGVW, is based on a number of sources. None of the numbers is particularly accurate. The primary reason for having information on this characteristic is that some allocation methodologies require such numbers. The only vehicle, however, where this really matters is the large truck. For these, information on weights was taken from a roadside survey conducted in 1983 on all Ontario highways (Perera and Corupe, 1984). In that survey, the average weight of all trucks was 23,300 kg and the average RGVW was 37,200 kg. About 4 percent of the trucks included weighed less than the cut-off point used here (4.5 tonne) to define "large" trucks. However, there is no accurate way of excluding these from the calculation of average weight.[3]

## A.3 TOTAL VEHICLE-KILOMETRES OF TRAVEL

It is estimated that all vehicles travel a total of 245.6 billion kilometres a year. The first line in column 5 of Table A.1 is the product of the number of cars times 17,380 km/yr, RTAC's estimate of the average annual passenger car usage (RTAC, 1990, p. 41, developed from Transport Canada's fuel consumption survey).

The remaining figures on Table A.1 for average distance are based roughly on figures used in the 1982 FHWA study (U.S., FHWA, 1982, Appendix C). They are rough as the vehicle categories used do not match those used here. There are some exceptions and/or qualifications to this use of U.S. figures:

- For large freight trucks, estimates of annual kilometres have been developed from Statistics Canada sources (Catalogue No. 53-222, 1988) as follows:

| | |
|---|---|
| total for-hire and private freight trucks | 165,073 |
| total distance travelled (km) | 7,337,110,973 |
| average distance travelled (km) | 44,448 |

These figures, which are based on the activity of *surveyed* for-hire and private truckers, exclude the operations of for-hire owner-operators. This probably results in a lower estimate of average distance; however, nothing is done here to correct this possible error. Further, this average of 44,448 kilometres is assumed to apply to the entire fleet of large trucks (that is, the "non-freight" as well as the freight trucks captured in Statistics Canada's survey).

- The average distance shown for buses in Table A.2 is based on the weighted average for three bus categories in the U.S. source: intercity buses, school buses and transit buses.
- The figures shown for "Other" vehicles is simply a guess.

## A.4 AVERAGE ANNUAL DAILY TRAFFIC

Six sources have been used to develop AADT estimates for the federal/provincial/territorial roads: TAC's data on volumes on the National Highway System and more detailed data from British Columbia, Saskatchewan, Ontario, Quebec and New Brunswick.

*National Highway System:* The NHS consists of 24,459 route kilometres or 33,169 kilometres of two-lane equivalent roads (National Highway Policy Steering Committee, 1988, Phase 1 Report) and represents 11.4 percent of federal/provincial/territorial roads. AADT figures for the NHS as given by RTAC are shown in Table A.2.

*Table A.2*
*TRAFFIC VOLUMES ON THE NATIONAL HIGHWAY SYSTEM*
*(FREQUENCY DISTRIBUTION BY AADT)*

| % of total NHS length (route-km) | AADT |
|---|---|
| 15 | >10,001 |
| 13 | 5,001–10,001 |
| 21 | 3,000–5,000 |
| 48 | < 3,000 |

**Source:** **RTAC, 1990, p. 30.**

The NHS consists of four road classes as shown in Table A.3 (it is unclear whether the total length is 24,459 or 24,359 kilometres). In the third column, lengths have been converted to two-lane equivalents, the total of which is known to be 33,169 kilometres. In column 4, traffic volumes from Table A.2 are roughly mapped into this NHS road-class system. For example, since it is known that 15 percent (3,654 kilometres) of the NHS has traffic volumes above 10,000, it is surmised that the 3,317 kilometres of freeways in the NHS are, in fact, this busiest segment of the NHS. This process was used to continue relating traffic volumes with road classes until all that was left is the least travelled 48 percent of the NHS. The last column of the table shows the traffic volumes on a two-lane equivalent basis.

*Table A.3*
*NATIONAL HIGHWAY SYSTEM TRAFFIC VOLUMES BY ROAD CLASS*
*(ESTIMATED)*

| 1 **Road class (NHPSC Phase 1 Report)** | 2 **Length (route-km)** | 3 **Two-lane equivalents (estimated)** | 4 **AADT (route-km)** | 5 **AADT (two-lane equiv.)** |
|---|---|---|---|---|
| Freeway | 3,317 | 9,393 | >10,001 | >5,001 |
| Multi-lane arterial | 2,733 | 5,466 | 5,001–10,000 | 2,500–5,000 |
| Two-lane paved | 17,722 | 17,722 | | |
| – about 1/3 | | | 3,001–5,000 | 3,001–5,000 |
| – about 2/3 | | | <3,001 | <3,001 |
| Gravel | 587 | 587 | <3,001 | <3,001 |
| | **24,359** | **33,169** | | |

The information in Table A.3 can be used to make assumptions about volumes on the 292,003-kilometre network, the basic one being that the busiest 33,169 kilometres are, in fact, the NHS. Freeways have more than 10,000 vehicles per day or, on a two-lane equivalent basis, more than 5,000 assuming a typical four-lane freeway. Those which are classified as "Paved (urban)" in TAC's data are, presumably, comparable to "multi-laned arterials" in the NHS system and, therefore, are assumed to have traffic volumes in the range of 5,000 to 10,000 vehicles per day (2,500 to 5,000 on a two-lane equivalent basis). As for the most important class of road in Canada — the two-lane paved rural highway — the NHS figures suggest that perhaps only about 5,000 kilometres have volumes in the range of 3,000 to 5,000 vehicles. The balance of 129,855 kilometres appears to have volumes of less than 3,000.

*British Columbia:* Although B.C.'s system of classifying roads does not quite map into the TAC nomenclature, it is close. With a small amount of estimating, the figures in columns 5 to 9 of Table A.4 have been developed. The total lengths are reasonably close to TAC's figures. The figures are thought to be for the summer of 1989. The "special" road class (column 8) has no AADT figures — the largest element of guesswork in Table A.4 is in placing 2,028 kilometres of this class within the "Earth" category.

*Table A.4*

### TRAFFIC VOLUMES ON BRITISH COLUMBIA ROADS
### (MAPPING OF INFORMATION INTO COLUMNS 5 TO 9 IS ESTIMATED)

| 1 Road class | 2 AADT | 3 Road km | 4 Two-lane equiv. | 5 Free-ways | 6 Rural (paved) | 7 Surface treated | 8 Gravel | 9 Earth |
|---|---|---|---|---|---|---|---|---|
| 1 | > 10,000 | 1,970 | 3,160 | 1,224 | 1,936 | | | |
| 2 | 5–10,000 | 2,273 | 2,612 | 43 | 2,567 | 2 | | |
| 3 | 1–5,000 | 7,085 | 7,426 | | 7,258 | 19 | 149 | |
| 4 | 500–1,000 | 4,056 | 4,073 | | 2,110 | 282 | 1,681 | |
| 5 | 100–500 | 7,188 | 7,190 | | 2,821 | 453 | 3,902 | 14 |
| 6 | 10–100 | 14,102 | 13,915 | | 2,387 | 560 | 10,608 | 360 |
| 7 | 0–10 | 5,431 | 4,917 | | 210 | 33 | 3,550 | 1,124 |
| 8 | special | 4,488 | 2,865 | | 71 | | 1,766 | 2,028 |
| | | | **46,158** | **1,267** | **19,360** | **1,359** | **21,656** | **3,526** |

**Source: British Columbia Ministry of Transportation and Highways.**

These are the salient points to note:

- Freeways have volumes of over 10,000 vehicles (that is, over 5,000 when converted to two-lane equivalents, confirming the NHS data).
- Paved rural roads — keeping in mind that the busiest ones shown in Table A.4 are four lanes — have traffic volumes of roughly the following magnitudes:

  23% — 5,000 to 10,000 vehicles per day (this includes those four-lane sections with total volumes over 10,000)
  38% — from 1,000 to 5,000 vehicles per day
  39% — less than 1,000 vehicles per day

- Surface-treated roads have volumes in the range of 10 to 1,000, with 100 to 500 vehicles per day being perhaps the most frequent volumes.

- Gravel roads have volumes of less than 100 vehicles per day.

- Earth roads have — at least those for which numbers are available — less than 10 vehicles per day.

*Saskatchewan:* Information from Saskatchewan is shown in Table A.5. The first two categories of road correspond roughly to TAC's "Freeway" and "Paved (rural)" roads (see RTAC, 1990, p. 8). The third class, in terms of total length, approximately corresponds to the total "Surface-Treated" roads in TAC's data, and the last class in Table A.5 is roughly comparable to the "Gravel" roads shown for Saskatchewan in TAC's data. The higher percentage of trucks in the traffic for this fourth category is accounted for by the large number of resource roads in Saskatchewan: just over 40 percent of the total 5,812 kilometres where, for example, logging trucks account for a high percentage of the total volumes. "Trucks" in the last column of Table A.5 are defined as "one tonne or more," compared to the "4.5 tonne or more" used in this report to distinguish between large and small trucks.

Table A.5
TRAFFIC VOLUMES ON SASKATCHEWAN ROADS

| Road class | Length (route km) | AADT (1989) | % Trucks (1 tonne or more) |
|---|---|---|---|
| Arterial highways | 3,515 | 2,475 | 15 |
| Collector highways | 6,332 | 770 | 13 |
| Local highways | 9,831 | 360 | 11 |
| Provincial roads | 5,812 | no data | 19 |

**Source: Saskatchewan Department of Highways and Transportation.**

*Ontario:* Information on VKT from Ontario is shown in Table A.6. To compute AADTs, it is necessary to make assumptions about the classification scheme used by TAC and that used by Ontario. "Freeways" is used in both sources: the length in the third column, however, is the two-lane equivalent from the TAC data. For the second row of Table A.6 — "highways" or, in the source, "other King's highways" — there is more guesswork involved. The Ontario source shows a total length of 14,268 kilometres; TAC shows a total of 16,394 "paved rural roads" on a two-lane equivalent basis. If these two lengths (14,268 in total and 16,394 in two-lane equivalents) were synonymous, the AADT would be as shown in the fourth column of the Table (3,441).

However, it is more likely that Ontario's "other King's highways" represent about 15,200 kilometres on a two-lane equivalent basis. The result is that the length for "Highways" on Table A.6 is probably overstated and the AADT shown in the last column is probably understated. The third line probably contains a better estimate of average traffic volumes on Ontario's "other King's highways." What Ontario refers to as "secondary highways" are shown on the last line of the Table. These, presumably, correspond with what TAC shows as "Gravel," "Surface-Treated," and a small portion of "Paved (rural)." The total length shown on Table A.6 of 5,725 kilometres is from the Ontario source; these are assumed to be the same as two-lane equivalents. TAC shows a total of 4,243 kilometres of gravel and surface-treated roads for Ontario; therefore, there are presumably 1,482 kilometres of paved rural roads included in the last line of Table A.6.

*Table A.6*

### TRAFFIC VOLUMES ON ONTARIO ROADS

| Highway class | Total 1989 VKT (million) | TAC length (two-lane equiv.) | AADT |
|---|---|---|---|
| Freeways | 23,842 | 3,754 | 17,400 |
| Highways | 20,592 | 16,394 | 3,441 |
| | | 15,200 | 3,712 |
| Secondary | 912 | 5,725 | 436 |

**Source: Ontario Ministry of Transportation, 1991, Part I.**

*Quebec:* Information on traffic volumes on Quebec highways is available at a very detailed level. Without a lot of work, however, it was not possible to use this with the highway classes employed here. In lieu of this, here are some observations (without converting to a two-lane equivalent basis):

- Autoroutes — traffic volumes range from over 40,000 vehicles per day in the Montreal area to less than 10,000 in some of the less populated regions.
- Highways — few of the highways (non-autoroute) have volumes exceeding 10,000 vehicles per day. Many of the major routes have volumes in the 1,000 to 5,000 range, while the many less-travelled highways have volumes of less than 1,000.

Information used to calculate broad average volume levels for Quebec are shown in Table A.7. As shown, autoroutes have an average volume, on a two-lane equivalent basis, of just over 10,000 vehicles per day, while other highways have an average volume of just over 1,000. Unlike other provinces, provincial roads account for a much higher proportion of all roads in the province and often include very low-volume roads.

*Table A.7*

*TRAFFIC VOLUMES ON QUEBEC ROADS*

| Highway class | Total 1989 VKT (million) | TAC length (two-lane equiv.) | AADT |
|---|---|---|---|
| Autoroute | 16,813 | 4,557 | 10,108 |
| Other highways | 21,759 | 56,087 | 1,063 |

**Source: Information from Québec Ministère des Transports.**

*New Brunswick:* Information on New Brunswick's "arterial highway network" — roughly 10 percent of total provincial roads, which are assumed to be the busiest roads in the province — has been published recently in a discussion paper (New Brunswick Department of Transportation, 1988). The points to note here are:

- Traffic volumes, in AADTs, on these arterial highways range from 1,000 to 10,000 vehicles per day, although there are a few four-lane sections near Saint John where the volumes are actually as high as 20,000, or 10,000 on a two-lane equivalent basis.
- The busiest highway in the province, the Trans-Canada Highway, has an average of 6,000 vehicles per day, whereas many of the other arterials are in the range of 2,000 to 3,000 (these are rough estimates as they are made on the basis of a quick inspection of a map showing highway sections and volumes).

### Estimated AADTs

This information from the NHS and five provinces can be used to estimate AADTs *on a two-lane equivalent basis* for the whole 292,003-kilometre network (the results are shown on Table 4.2):

- Freeways — All sources indicate AADTs above 5,000 vehicles per day. Ontario information suggests a province-wide average of 17,400, and Quebec sources indicate a province-wide average of 10,108. Ontario and Quebec together account for 63 percent of all freeways (two-lane equivalent lengths) in Canada. The combined average for the two is 13,402. However, the very high volumes in Ontario — in some places through Toronto, Highway 401 has over 40,000 vehicles per day on a two-lane equivalent basis — are not typical of volumes elsewhere. Therefore, a Canada-wide average of 12,000 is used here.

- Paved urban roads — Paved urban roads represent a tiny fraction of the TAC network (0.4 percent) and, other than the NHS data, there is not much information on traffic. For here, an average of 4,000 is assumed.

- Paved rural roads — This is by far the most important component of the network and, for that reason, traffic volumes were estimated in terms of three different types: high, medium and low volume. The NHS data seem to indicate there may be 5,000 kilometres of these roads with volumes in the range of 3,000 to 5,000. The province-wide data for British Columbia suggest a figure of between 5,000 and 10,000. Saskatchewan's data give averages of 770 and 2,475 for two different components of the network. Ontario's data suggest a province-wide average of 3,500 to 3,700 (with some sections of paved road, which fell into the next lower highway classification, having lower volumes). Quebec's data indicate a provincial average of just over 1,000 vehicles a day, but this includes all paved, surface-treated and gravel roads. New Brunswick's information, for roughly 2,000 kilometres of (mainly) two-lane paved roads — out of a province-wide total of 4,200 — suggests volumes in the range of 1,000 to 10,000. It was assumed that the balance of New Brunswick's paved rural roads have volumes considerably less than this. For this research, these are the volumes assumed:

- First, there are the high-volume rural highways with volumes assumed to be 6,000 vehicles per day. It was also assumed that these roads account for 10 percent of the total (that is, just under 13,000 kilometres across Canada).

- Second, another 30 percent of the rural paved roads (39,000 kilometres) were assumed to have volumes of 3,000 vehicles per day.

- Third, the remaining 60 percent of the rural paved roads (78,000 kilometres) were assumed to have volumes of 700 vehicles per day.

- Surface-treated roads — The figures for British Columbia suggest an average of, perhaps, 500 vehicles per day; Saskatchewan's data indicate an average of 360; and the information from Ontario shows an average of 436, although this is on the high side as it is known that the road category with these volumes includes some paved roads. For here, surface-treated roads were assumed to have 350 vehicles per day.
- Gravel — Gravel roads were assumed to have 50 vehicles per day.
- Earth — Earth roads (all 4,903 kilometres within the federal/provincial/territorial domain) were assumed to have 10 vehicles per day.

To check the reasonableness of these estimates, the AADTs can be multiplied by highway lengths. The product can then be compared with the estimate of total VKT (245.6 billion) with an allowance made for the split in VKT between federal, provincial, territorial roads and municipal roads. Data from Ontario can be used for this, although it is recognized that travel patterns in other provinces or, indeed, the distinction between municipal and provincial roads, may well differ from one jurisdiction to another.

In 1989 in Ontario, there were an estimated 76,917 million VKT of which 45,360 million, or 59 percent, occurred on provincial roads (Ontario: Ministry of Transportation, 1991, p. I-003).[4] Multiplying the AADTs shown on Table 4.2 times the lengths shown on Table 3.1 and the resulting product by 365, produces the estimate of 157.9 billion VKT which is 64 percent of the estimated total 245.6. In other words, the estimated AADTs are reasonable in light of the estimated total VKT and the assumption that the split in travel between provincial and municipal roads in Canada is similar to that found in Ontario.

Another, partial, check on the procedures is a comparison of the estimated VKT derived by multiplying AADTs by lengths with the data (that is, excluding municipal roads) from an individual province. This has been done, but the results are not good. In effect, what happens is that the estimated national average AADTs overestimate VKTs in provinces with low volumes and underestimate VKTs for provinces with high volumes (Ontario).

## A.5 TRUCK TRAFFIC

Data from three provinces have been obtained on the proportion of total traffic accounted for by trucks. Saskatchewan's information, on trucks "over one tonne," is shown in Table A.5. Ontario's information is not as concise: it is a large colour-coded map showing sections of the road network in terms of the proportion of truck traffic (Ontario: Ministry of Transportation and Communications, 1985). Without a lot of work, it is impossible to "add" these sections up to develop provincial averages. Nevertheless, the Ontario data can be used to make the following observations:

- The major freeways have large sections coded in the 15 to 19.9 percent and the 20 to 40 percent truck range. The exceptions are for those freeways around Toronto where commuters dominate or for those freeways heading to resort country.
- Generalizations about two-lane major provincial highways are difficult. In Northern Ontario, many have very heavy truck traffic: large portions of Highway 17 are coded 20 to 40 percent. But in Southern Ontario, there is considerable variability: many highways are coded "less than 8 percent," while many others sections of other highways are in the 8 to 10.9 percent and 11 to 14.9 percent range.

Only partial information on truck volumes has been obtained from New Brunswick: on the Trans-Canada Highway (TCH), the busiest highway in the province (except for the freeways near cities) with an average AADT of 6,000, truck volumes are 1,000 per day, or 17 percent, on average. Since the TCH is a major truck route, it was assumed that this figure represents the high end of the range for two-lane paved rural roads in Atlantic Canada.

With only these Saskatchewan, Ontario and New Brunswick data to rely on, and with either inconsistent definitions of "trucks" or definitions which cannot be related to the "4.5 tonne" demarcation line, assumptions made about truck traffic were obviously speculative. The procedure started with an assumption that truck traffic on freeways was 20 percent of AADTs and that it was 15 percent elsewhere. These were the steps that followed:

- A matrix was set up showing road classes by vehicle classes (see Table A.8). Given the AADTs estimated (Table 4.2) and the percent of trucks (20 percent or 15 percent), the balance of the AADTs were distributed to other vehicle classes roughly in proportion to the total annual VKT (Table A.1).
- The only major adjustment to these procedures was the assumption that trucks spend a larger proportion of their time on provincial (federal, provincial, territorial) roads than cars. This means that the proportion of

total travel on provincial roads is not quite the same as that shown in column 5 of Table A.1.

- Through a series of iterations, "% truck" was adjusted downwards until the final estimate of VKT was *less than* the total VKT shown on Table A.1. Obviously, figures could not be used which suggested that any vehicle class did more travel on provincial roads than it did on all roads implicit in the estimate of total travel in Table A.1.

The results of these steps are shown in Table A.8. The first line under "VKT" is the total travel calculated in Table A.1; the second line is the product of AADT times percent times 365 times road length; and the last line shows the percent of total travel for each vehicle class that is assumed to occur on the provincial road network (the balance being on municipal roads). These are quite speculative numbers.

*Table A.8*

*TRAFFIC, BY ROAD CLASS, BY VEHICLE CLASS*

| | | Distribution of traffic (%) | | | | | |
|---|---|---|---|---|---|---|---|
| **Roads** | **AADTs** | **Cars** | **Small trucks** | **Large trucks** | **Buses** | **Motor-cycles** | **Other** |
| Freeways | 12,000 | 67 | 17 | 15 | .5 | .5 | .25 |
| Paved (urban) | 4,[illegible]00 | 73 | 18 | 7 | .5 | .5 | .25 |
| Paved (rural) | | | | | | | |
| – busiest 10% | 6,000 | 69 | 17 | 13 | .5 | .5 | .25 |
| – medium-volume | 3,000 | 73 | 18 | 7 | .5 | .5 | .25 |
| – low-volume | 700 | 73 | 18 | 7 | .5 | .5 | .25 |
| Surface-treated | 350 | 73 | 18 | 7 | .5 | .5 | .25 |
| Gravel | 50 | 73 | 18 | 7 | .5 | .5 | .25 |
| Earth | 10 | 73 | 18 | 7 | .5 | .5 | .25 |
| VKT $10^9$ | | | | | | | |
| Table A.1 | | 178.1 | 41.6 | 22.6 | 1.2 | 1.4 | 0.7 |
| Provincial | | 110.7 | 27.7 | 17.5 | 0.8 | 0.8 | 0.4 |
| % Provincial | | 62.2% | 66.6% | 77.1% | 66.5% | 56.4% | 54.9% |

## A.6 LEFS

The number of LEFs for any individual truck varies considerably. However, what is needed for the development of an aggregate national profile of vehicles and traffic is some measure of the "average" truck. The only readily available source on this (again, from Ontario) is a recent paper from the Ontario Ministry of Transportation (Hajek et al., 1991, Table 2). While there are concerns about how this ESAL was calculated and concerns about the suitability of using observations from two highway sites to extrapolate across all of Canada, in lieu of any other information, it is assumed that the average truck produces 1.5 ESALs. As for other vehicles, their numbers or their total VKT are either so small or else their axle weights so low, that all that is required here is a reasonable assumption about LEFs. These are shown in Table A.9.

*Table A.9*
*ASSUMED AVERAGE VEHICLE LEFS*

| LEFs (AASHTO ESALs) per vehicle | | Annual ESALs per two-lane km | |
|---|---|---|---|
| Passenger cars | 0.00001 | Freeway | 986,347 |
| Small trucks | 0.00007 | Paved (urban) | 153,585 |
| Large trucks | 1.50000 | Paved (rural) | |
| Buses | 0.02000 | – busiest 10% | 427,475 |
| Motorcycles, etc. | 0.00000 | – medium-volume | 115,189 |
| Other | 0.03000 | – low-volume | 26,877 |
| | | Surface-treated | 13,439 |
| | | Gravel | 1,920 |
| | | Earth | 384 |

To check the reasonableness of these estimates, assumed LEFs per vehicle have been multiplied by total traffic volumes to produce an average loading for each road class. These are also shown on Table A.9 (and, as discussed in Section 2, it is suspected that the measure of LEF used here is not relevant for the last three classes of roads shown). While it is difficult to know how accurate the estimates of loadings are, the numbers appear reasonable.

## APPENDIX B: CALCULATION OF EQUIVALENCY FACTORS

For this research AASHTO ESALs have been calculated by estimating the relationships shown in a recent Transportation Research Board (TRB) study (U.S. TRB, 1990, Fig. 4-3). ESALs could have been developed directly from the AASHTO manuals or Figure 2.2 for a typical flexible pavement; however, at the time they were needed, the TRB reference was the handiest material. In that study, for a flexible pavement with a SN of 5 and a terminal serviceability of 2.5, ESALs for various axle loads are shown as indicated in column 3 of Table B.1. In column 4, the predicted ESALs are shown using the following (measured in tonnes):

$$\text{single axle} = \left(\frac{\text{load}}{8{,}163}\right)^4$$

$$\text{tandem axle} = \left(\frac{\text{load}}{15{,}079}\right)^4$$

$$\text{tridem axle} = \left(\frac{\text{load}}{21{,}678}\right)^4$$

*Table B.1*

*ACTUAL VERSUS PREDICTED ESALS*

| 1<br>Axle type | 2<br>Axle loads ('000 lb) | 3<br>Indicated ESAL | 4<br>Predicted ESAL |
|---|---|---|---|
| Single | 9 | 0.06 | 0.063 |
| | 12 | 0.19 | 0.198 |
| | 16 | 0.62 | 0.624 |
| | 19 | 1.24 | 1.241 |
| | 20 | 1.51 | 1.524 |
| Tandem | 28 | 0.50 | 0.503 |
| | 30 | 0.65 | 0.663 |
| | 32 | 0.86 | 0.858 |
| | 33 | 0.97 | 0.970 |
| | 34 | 1.09 | 1.093 |
| Tridem | 40 | 0.49 | 0.500 |
| | 42 | 0.60 | 0.602 |

Canadian LEFs are calculated in one of two ways. First, the Canroad LEFs are calculated as they were determined in the original Canroads Study (Canroad, 1986, Part 2). Load, in both these and what follows, is measured in tonnes.

$$\text{single axle} = 0.002418 \times \text{load}^{2.9093}$$

$$\text{tandem axle} = 0.001515 \times \text{load}^{2.543}$$

$$\text{tridem axle} = 0.002363 \times \text{load}^{2.113}$$

Second, Waterloo's method of calculating them is as follows (Rilett, 1988, pp. 57, 60, 62):

$$\text{single axle} = 0.0153598 \times \text{load}^{2.159}$$

$$\text{tandem axle} = 0.001142 \times \text{load}^{2.704}$$

$$\text{tridem axle} = 0.0006205 \times \text{load}^{2.639}$$

The Canroad and Waterloo LEF calculations are based on the same data, but differ because of the way in which the pavement damage was accumulated under multiple axle groups.

For single steering axles, it is assumed for both the Canroads and Waterloo LEFs that the LEFs shown above for single axles are doubled (that is, because they have half the tire contact).

# APPENDIX C: ANALYSIS OF MAINTENANCE EXPENSES

Annual reports of the roads departments from all provinces have been reviewed. Information from several of these can be used to develop an estimate of the proportion of maintenance expenses which are pavement related.

The six items in Nova Scotia's maintenance accounts which clearly relate to pavements comprise 9.1 percent of the total. The total excludes "aid to municipalities." Presumably, with some of the other items on the list (for example, "worker's comp") prorated to the various activities (such as pavements), the pavement component of these expenses would be higher. Maintenance expenses for Prince Edward Island are not broken out in as much detail as those for Nova Scotia. Nevertheless, the two broad items which are clearly related to pavements amount to 25.0 percent of the total. What is not known is if there are activities included within these items which are not related to the deterioration of pavements through either axle loads or environmental factors. The three items in Alberta's maintenance accounts for the year 1989-90 which clearly relate to pavements — regravelling, gravel surfaces; crack sealing; and pavement patching — amount to 17.0 percent of the total.

Finally, the maintenance expenses for Ontario for the fiscal year ending March 31, 1991 have been examined. The eleven broad headings used in these accounts are generally self-explanatory. "Roadside" includes everything to do with the side of the road (mowing, cleaning, fences, etc.); "drainage" includes such things as culverts and bridges; and "safety" includes line painting, electrical work, signs and guide rails. The account entitled "surface" amounts to 4.9 percent of the total. Alternatively, if "overheads" are removed from the figures, "surface" accounts for 5.6 percent of all activities.

A summary of this information — that is, total pavement-related maintenance costs — is shown in Table C.1. Because of the various terminology and because of various practices used to "load" certain expenses onto others, this is only a general identification of these expenses. The portion of maintenance expenses related to pavements is assumed to lie between 6 and 20 percent and, in lieu of any better information, 15 percent is used as a broad average in this study.

### Table C.1
### SUMMARY OF PAVEMENT-RELATED MAINTENANCE EXPENSES

| Province | Pavement-related maintenance expense ($ million) | Provincial road length (TAC, two-lane equiv.) | Cost per km ($) |
|---|---|---|---|
| Alberta | 11.49 | 37,847 | 304 |
| Ontario | 11.46 | 24,391 | 470 |
| Prince Edward Island | 7.28 | 4,920 | 1,479 |
| Nova Scotia | 8.85 | 23,458 | 377 |

# APPENDIX D: COMPUTATIONS OF ROAD COSTS

As a number of the methodologies available for allocating costs use the same variables, Table D.1 summarizes the important information developed from Appendix A.

*Table D.1*

*CANADIAN VEHICLE FLEET, VKT, ESAL-KM AND GVW-KM*

| | VKT (billion) | ESAL-km (billion) | GVW-km (billion) |
|---|---|---|---|
| Passenger cars | 110.7 | 1.1 | 110.7 |
| Small trucks | 27.7 | 1.9 | 41.5 |
| Large trucks | 17.5 | 26,200.3 | 406.9 |
| Buses | 0.8 | 15.8 | 5.5 |
| Motorcycles, etc. | 0.8 | 0.0 | 0.2 |
| Other | 0.4 | 11.8 | 3.2 |
| **Total** | **157.9** | **26,231.0** | **568.1** |

## D.1 FHWA (1982) METHODOLOGY

The methodology employed by the FHWA is concerned largely with the costs of new roads. None of this is applicable to TAC's data. Further, as the FHWA methodology does not consider maintenance (that is, "routine maintenance"), there is no guide to the allocation of these costs. All that could be used from the FHWA study was its method of allocating the costs of existing bridges and existing pavements. Bridges are relatively easy; they are allocated on the basis of VKT, with a resulting cost of $0.002 (Can) for all vehicles. Existing pavement costs are allocated on the basis of distress models which cannot be replicated here. Rather, the best that could be done was to distribute total TAC pavement costs in roughly the same proportion as is done in the FHWA (Table D-4, in the 1982 report). This is a rough approach as there is not a one-to-one correspondence between vehicle classes.

The allocation of existing pavement costs, according to the FHWA method, is shown on Table D.2. The assumption was that the fleet characteristics in Canada are sufficiently close to those in the U.S. to warrant the use of the ratios shown in the second column. This may be a weak assumption. The final allocation of costs, excluding TAC's maintenance and administration, is shown in Table D.3.

### *Table D.2*
### FHWA ALLOCATION OF EXISTING PAVEMENT COSTS

| Vehicle class | FHWA allocation ratios (%) | TAC costs allocated ($ million) | Costs per km |
|---|---|---|---|
| **Adjusted TAC costs** | | | |
| Automobiles | 15.40 | 313.6 | 0.003 |
| Small trucks | 17.51 | 356.5 | 0.013 |
| Large trucks | 62.72 | 1,277.1 | 0.073 |
| Buses | 2.27 | 46.2 | 0.059 |
| Motorcycles, etc. | 0.11 | 2.2 | 0.003 |
| Other | 1.99 | 40.5 | 0.103 |
| **Optimal TAC costs** | | | |
| Automobiles | 15.40 | 251.8 | 0.002 |
| Small trucks | 17.51 | 286.3 | 0.010 |
| Large trucks | 62.72 | 1,025.6 | 0.059 |
| Buses | 2.27 | 37.1 | 0.047 |
| Motorcycles, etc. | 0.11 | 1.8 | 0.002 |
| Other | 1.99 | 32.5 | 0.082 |

### *Table D.3*
### FHWA ALLOCATION OF PAVEMENT AND BRIDGE COSTS

| Vehicle class | TAC costs allocated ($ million) | % distribution | Costs per km |
|---|---|---|---|
| **Adjusted TAC costs** | | | |
| Automobiles | 521.4 | 22.4 | 0.005 |
| Small trucks | 408.5 | 17.5 | 0.015 |
| Large trucks | 1,309.8 | 56.2 | 0.075 |
| Buses | 47.7 | 2.0 | 0.060 |
| Motorcycles, etc. | 3.7 | 0.2 | 0.005 |
| Other | 41.3 | 1.8 | 0.105 |
| **Pavement costs — total** | **2,332.4** | | |
| **Optimal TAC costs** | | | |
| Automobiles | 459.7 | 19.7 | 0.004 |
| Small trucks | 338.3 | 14.5 | 0.012 |
| Large trucks | 1,058.4 | 45.4 | 0.061 |
| Buses | 38.6 | 1.7 | 0.049 |
| Motorcycles, etc. | 3.3 | 0.1 | 0.004 |
| Other | 33.3 | 1.4 | 0.084 |
| **Pavement costs — total** | **1,931.5** | | |

## D.2 U.K. METHODOLOGY

It is not possible to make a one-to-one linkage of the expenditure and road categories in the U.K. method with those available in TAC's data. An important difference is that "maintenance costs," as used in the U.K. DoT's organization of expenditures, encompasses all costs included in TAC's data. In fact, it actually includes more items than TAC's (for example, expenses on "footways, cycle tracks and kerbs"), but the point is that none of the parts of the U.K. method which applies to what they refer to as "capital" expenditures can be transferred. These amounts, in the parlance of the U.K. authors, are for "new construction and improvements." Another difference is that the U.K. method applies to all roads, including what would be called local in Canada. Since these are not part of the TAC data used here, adjustments have to be made.

The three primary characteristics used to allocate the U.K. "maintenance costs" are VKT, average GVW-km and the "standard-axle-km." For here, this last variable is defined as an ESAL-km. While not possible to make a direct link between the categories of "maintenance" in the U.K study and those in the TAC data, a close approximation is as follows:

*ESAL-km costs:* All reconstruction and resurfacing expenses, and a portion of what are included in TAC as maintenance, are allocated on the basis of standard-axle loads times distance travelled. The portion of expenses other than reconstruction and resurfacing which are allocated in this manner are labelled "patching and minor repairs." TAC's costs allocated on the basis of ESAL-km are reconstruction, resurfacing, and 15 percent of maintenance. The following are the resulting ESAL-km costs by road class:

| | Adjusted TAC | Optimal TAC |
|---|---|---|
| Freeways | $0.020 | $0.012 |
| Paved (urban) | 0.102 | 0.071 |
| Paved (rural) | 0.130 | 0.106 |
| Surface-treated | 0.515 | 0.524 |
| Gravel | 1.045 | 1.045 |
| Earth | 2.405 | 2.405 |

The concept of LEF as calculated here may be entirely inappropriate for the last three road classes.

*GVW-km costs:* The main expenditure in the U.K. system allocated on the basis of GVW-km is bridge costs. In addition, certain other portions of what in the TAC data would be included under maintenance are also allocated in this manner. For here, then, bridge costs plus 15 percent of maintenance are allocated according to the number of GVW-km for each vehicle class. The following are the results:

| | |
|---|---|
| Total bridge + 15% of maintenance<br>– adjusted and optimal TAC = | $570,783,688 |
| Cost per GVW-km | $0.0010 |

*VKT:* All remaining costs — in TAC's terminology, administration plus 70 percent of maintenance — are allocated on the basis of VKT. In fact, in the U.K. method, some are allocated on the basis of the number of pedestrians but, as these are for local roads, this factor is not applicable to TAC's data. The result is as follows:

| | Adjusted TAC | Optimal TAC |
|---|---|---|
| Cost per km | $0.0092 | $0.0091 |

Table D.4
COST ALLOCATION: U.K. METHOD + ADJUSTED TAC

| | Total costs ($ million) | % distribution | Cost per km |
|---|---|---|---|
| Passenger cars | 1,130.4 | 26.1 | $0.010 |
| Small trucks | 296.7 | 6.8 | 0.011 |
| Large trucks | 2,876.8 | 66.4 | 0.165 |
| Buses | 14.6 | 0.3 | 0.018 |
| Motorcycles, etc. | 7.4 | 0.2 | 0.009 |
| Other | 8.1 | 0.2 | 0.021 |
| **Total** | **4,334.0** | **100.0** | |

*Table D.5*

*COST ALLOCATION: U.K. METHOD + OPTIMAL TAC*

| | Total costs ($ million) | % distribution | Cost per km $ |
|---|---|---|---|
| Passenger cars | 1,118.7 | 28.6 | 0.010 |
| Small trucks | 293.8 | 7.5 | 0.011 |
| Large trucks | 2,474.6 | 63.2 | 0.142 |
| Buses | 14.2 | 0.4 | 0.018 |
| Motorcycles, etc. | 7.3 | 0.2 | 0.009 |
| Other | 7.8 | 0.2 | 0.020 |
| **Total** | **3,916.6** | **100.0** | |

## D.3 AUSTRALIAN METHODOLOGY

Expenditures categories in the Australian study are broader than those in TAC's data. A rough comparison of the two is shown in Table D.6; the final four columns show the allocation factors used by the Australians.

Expenditure categories included within the Australian method, but excluded here, are traffic management; "minor asset extensions or improvements" (for example, intersection upgrades, auxiliary lanes); major asset extension; and "other miscellaneous activities" (for example, the vehicle registration and driver licensing system). The mapping of the expenditure categories in the first column with the TAC categories in the second involves some judgement. The first category of maintenance, pavement and shoulders, is roughly analogous with the 15 percent of TAC maintenance which is thought to be related to pavements. The division of bridge expenses between load and non-load is based roughly on the division of these expenditures in the Australian data.

### Table D.6
### AUSTRALIAN ALLOCATION FACTORS

| Australian categories | TAC categories | Separable | | | Non-separable |
|---|---|---|---|---|---|
| | | GVW-km | VKT | ESAL-km | VKT |
| Servicing and operating | Administration | | | | 100% |
| Road maintenance | | | | | |
| – pavement and shoulders | 15% of maintenance | | | 60% | 40% |
| – resurfacing | Resurfacing | 10% | | 20% | 70% |
| – other | 85% of maintenance | | 15% | | 85% |
| Bridges – load related | 42% of bridge exp. | 100% | | | |
| – non-load related | 58% of bridge exp. | | | | 100% |
| Reconstruction | Reconstruction | | | 60% | 40% |

The separation of TAC's data into the allocation categories suggested by the Australian method are shown in Table D.7

### Table D.7
### DISTRIBUTION OF TAC COSTS, BY AUSTRALIAN METHOD

| Australian allocation factors | TAC adjusted costs % distribution | TAC optimal costs % distribution |
|---|---|---|
| Separable | | |
| – ESAL-km | 25.1 | 21.7 |
| – GVW-km | 4.6 | 5.1 |
| – VKT | 5.4 | 6.0 |
| Non-separable | | |
| – VKT | 64.9 | 67.3 |

### Table D.8
### COST ALLOCATION: AUSTRALIAN METHOD + ADJUSTED TAC

| | Total costs ($ million) | % distribution | Cost per km $ |
|---|---|---|---|
| Passenger cars | 2,175.5 | 50.2 | 0.020 |
| Small trucks | 548.8 | 12.7 | 0.020 |
| Large trucks | 1,567.4 | 36.2 | 0.090 |
| Buses | 17.8 | 0.4 | 0.023 |
| Motorcycles, etc. | 15.3 | 0.4 | 0.019 |
| Other | 9.2 | 0.2 | 0.023 |
| **Total** | **4,334.0** | **100.0** | |

*Table D.9*

### COST ALLOCATION: AUSTRALIAN METHOD + OPTIMAL TAC

| | **Total costs ($ million)** | **% distribution** | **Cost per km $** |
|---|---|---|---|
| Passenger cars | 2,050.6 | 52.4 | 0.019 |
| Small trucks | 517.5 | 13.2 | 0.019 |
| Large trucks | 1,308.6 | 33.4 | 0.075 |
| Buses | 16.8 | 0.4 | 0.021 |
| Motorcycles, etc. | 14.4 | 0.4 | 0.018 |
| Other | 8.7 | 0.2 | 0.022 |
| **Total** | **3,916.6** | **100.0** | |

# APPENDIX E: EXPLORATORY COST ALLOCATION

The following allocation methodology is labelled "exploratory" as more work is required to develop many of the underlying variables — such as the traffic and vehicle characteristics presented in Appendix A — before much confidence could be placed in the results. Further, more testing of the calculations — sensitivity analysis and extension of the findings to particular vehicles on particular roads — is needed.

The method starts with TAC's costs as described in Section 3. It then modifies these according to the information in Sections 2 and 5. Owing to the gaps in the knowledge about roads other than those with flexible pavements and owing to the insignificance of urban paved roads (in the data used here), only two classes of roads are considered: freeways and rural paved roads. In TAC's original numbers, these two account for 76.6 percent of total maintenance and pavement costs (Table 3.3). Rural paved roads, however, are separated into three categories according to the AADT estimates in Appendix A.

The first step is to establish the level of unit costs shown in Table E.1:

- Maintenance — Annual costs are as shown in Table 3.7 (adjusted TAC costs) or Table 5.5 (optimal TAC costs, which are the same as the adjusted). However, the amount shown for rural paved roads ($7,743) is adjusted on the assumption that maintenance activities vary with traffic. For the busiest 10 percent of the rural paved roads (AADT of 6,000 on average) maintenance costs per kilometre are $9,292. For the mid-volume rural paved roads (AADT of 3,000), maintenance costs are $7,743. For the lowest-volume rural paved roads (AADT of 700), maintenance costs are $7,485. These amounts, times the TAC lengths, equal the $1.0 billion shown in TAC's original figures. In other words, to reflect the fact that maintenance costs are probably higher on the busier roads than on lower-volume roads, TAC's costs have been assigned to each of the three categories in the proportion 12:30:58, even though total lengths are in the proportion 10:30:60. (This 12:30:58 is arbitrary.)
- Resurfacing — Costs for freeways and the highest-volume rural paved roads are $65,000 per two-lane kilometre. For other roads, they are set at $55,000. Overlays are assumed to last 12 years. These values are as discussed in Section 5.3.

- Reconstruction — Costs, given an initial pavement life of 15 years, are based roughly on the relationships shown in Figure 5.3 and the axle loadings shown for each road class shown on Table A.9.

Table E.1
EXPLORATORY COST ALLOCATION: UNIT COSTS
(1989 $, TWO-LANE EQUIVALENT BASIS)

| Roads | Maintenance costs/km | Resurfacing costs/km | Reconstruction costs/km |
|---|---|---|---|
| Freeway | 10,355 | 65,000 | 225,000 |
| Paved (rural) | | | |
| – busiest 10% | 9,292 | 65,000 | 200,000 |
| – medium-volume 30% | 7,743 | 55,000 | 170,000 |
| – low-volume 60% | 7,485 | 55,000 | 160,000 |

Bridge costs have to be dealt with on a system-wide basis as there is no way of separating bridges by road class. Total annual cost remains at TAC's estimate of $296.3 million. Administration costs remain at TAC's estimate of 4.12 percent of other costs.

The costing model is shown in Table E.2, where *E* represents a factor to account for environmental deterioration. Fixed costs and some of the variable costs are allocated according to VKT, rather than PCE-km as the second measure is really related to capacity.

Table E.2
ALLOCATION PROCEDURES
(INCLUDING ASSUMPTIONS ABOUT FIXED VERSUS VARIABLE COSTS)

| | Fixed costs | | Variable costs | |
|---|---|---|---|---|
| Expense | Amount | Allocation factor | Amount | Allocation factor |
| Administration | total | VKT | | |
| Bridges | 58% total | VKT | 42% total | GVW-km |
| Maintenance | 70% total<br>15% total × *E* | VKT<br>VKT | 15% total<br>15% total × (1 – *E*) | VKT<br>ESALs |
| Resurfacing | total × *E* | VKT | total × (1 – *E*) | ESALs |
| Reconstruction | total × *E* | VKT | total × (1 – *E*) | ESALs |

- Administration — These expenses are treated as a fixed cost.
- Bridge — Following the example of the Australian study, 58 percent of bridge expenses are assumed not to vary with usage and the balance are assumed to be a function of vehicle weight.
- Maintenance — From Appendix C, it is assumed that 15 percent of these expenses are related to pavement surfaces and, therefore, a function of both axle loads and environmental wear. (As shown in Table E.2, then, if E equals 50%, 7.5% of pavement-related maintenance expenses vary with usage and 7.5% do not.) As for the remaining maintenance expenses, the evidence suggests that some portion varies with traffic (see the Australian study or the discussion in Section 2). Examples of such expenses might be road-side cleaning, litter control, or line striping. For here, this traffic-related maintenance expense is assumed to be 15 percent of the total. Finally, the remaining 70 percent of maintenance is assumed to be a fixed cost. In most provinces, a good deal of this would be snow and ice control, that is, expenses incurred whether one vehicle or thousands of vehicles use the road.
- Resurfacing and Reconstruction — As with the pavement-related portion of maintenance, these expenses are functions of both axle loads and the environment. The amount attributed to axle loads is allocated according to ESALs and the remainder is treated as a common cost.

To allocate pavement costs, the unit costs shown in Table E.1 have to be converted to annual amounts. There are several ways of doing this. If initial pavement lives and overlay lives for the whole network are as follows:

$n_1$ = initial pavement life
$n_2$ = overlay #1 life
$n_3$ = overlay #2 life

then, assuming a steady-state system, in any given year,

$1/[(n_1 + n_2 + n_3)/2]$ parts of the network will be resurfaced

and

$1/(n_1 + n_2 + n_3)$ parts of the network will be reconstructed.

For the whole network, this results in an average annual cost per kilometre of the unit costs shown in Table E.1 times these two factors. For example, where $n_1$, $n_2$ and $n_3$ equal 15, 12 and 12 respectively, the average reconstruction cost per kilometre for a freeway is $5,769 (225,000/39) and the average resurfacing cost is $3,333 (65,000/19.5).

This is more or less identical to the methodology employed by RTAC in calculating its expenditure needs. Using this method, the unit costs shown in Table E.1, and the $n_1$, $n_2$, $n_3$ values given in the previous example, average annual costs per kilometre for the network are shown in Table E.3. These result in a total annual cost of $2.211 billion for pavements and maintenance. (This is for all federal, provincial and territorial freeways and rural paved highways.) The comparable figures from TAC's data are:

| | |
|---|---|
| $3.520 | original TAC data, in Table 3.2 |
| $2.812 | adjusted TAC data, in Table 3.6 |
| $2.413 | optimal TAC data, in Table 5.4 |

To test this allocation method, here is a listing of the key data and/or assumptions:

- Road lengths — These are as provided by TAC. However, as described in Appendix A, paved rural roads have been separated into three categories according to AADT. This is necessary as it is unrealistic to deal with all paved rural roads in Canada using broad national averages for the critical variables. Even more categories would be preferable.
- Traffic distribution — Five vehicle classes are distributed across road categories as described in Appendix A. The importance of this step is that it distributes both VKT and ESALs to various roads. Among the many critical assumptions here are the figures used to assume how many vehicles out of the total population of registration statistics actually exist and are in use; the (sometimes quite shaky) estimates of annual average distances; and the figures used to measure the percent of large trucks in the total traffic stream.

Table E.3

### Exploratory Cost Allocation: Average Annual Costs
### 1989 $, two-lane equivalent basis

| Roads | Maintenance costs/km | Resurfacing costs/km | Reconstruction costs/km |
|---|---|---|---|
| Freeway | 10,355 | 3,333 | 5,769 |
| Paved (rural) | | | |
| - busiest 10% | 9,292 | 3,333 | 5,128 |
| - medium-volume 30% | 7,743 | 2,821 | 4,359 |
| - low-volume 60% | 7,485 | 2,821 | 4,103 |

- Vehicle characteristics — Are as described in Appendix A. Among other things, this fixes the average truck weight (GVW, *not* RGVW) at 23.3 tonnes and the average number of LEFs for a truck at 1.5. Given the use of both GVW-km and ESALs to allocate costs, these are two of the more critical aspects of vehicle characteristics.

- Pavements — Although actual designs vary from one section of the 143,296-kilometre network to another (this is just the freeway and rural paved highway component), the rough assumption made here is that pavements are built to handle the following loads (per year):

| | |
|---|---|
| Freeways | about one million ESALs |
| Busiest rural highways | about 425,000 ESALs |
| Medium-volume rural highways | about 115,000 ESALs |
| Low-volume rural highways | about 25,000 ESALs |

- Maintenance costs — Although TAC's numbers are used, the amounts for rural paved highways are altered slightly in recognition of the fact that maintenance activities may vary with traffic.

- Resurfacing and reconstruction costs and frequencies — These are as described above.

- Environmental pavement deterioration — The following amounts for the proportion of pavement deterioration caused by factors other than axle loads are assumed:

| | |
|---|---|
| Freeways | 40% |
| Busiest rural highways | 50% |
| Medium-volume rural highways | 70% |
| Low-volume rural highways | 80% |

An even more fundamental assumption, of course, is that the relationships discussed in Sections 2 and 5, based on the OPAC model of pavement performance and typical Ontario construction costs, are applicable to the Canada-wide network.

The first step in the allocation is the treatment of bridge and administration costs as described previously. Total GVW-km are 568.1 billion, the product of total VKT and average weights shown in Appendix A. This results in an annual variable bridge cost of $0.0002 per GVW-km for all vehicles, where GVW is measured in tonnes (bridge costs times 0.42, all divided by 568.1 billion). Cars, for example, incur a cost of exactly $0.0002 as the average weight for these vehicles in Appendix A is one tonne. Large trucks, on the other hand, have an average bridge cost of $0.0047 per kilometre (23.3 tonnes times $0.0002). The remaining bridge costs, assuming it is appropriate to allocate fixed costs according to distance driven, amount to $0.0011 per kilometre (over the whole network, not just the paved roads considered in this Appendix).

The second step is to separate those maintenance and pavement costs which vary with usage from those that do not according to the procedures described in Table E.2. The results are shown in Table E.4.

*Table E.4*
*EXPLORATORY COST ALLOCATION: VARIABLE VERSUS FIXED COSTS*
*(1989 $, TWO-LANE EQUIVALENT BASIS)*

| Road class | Variable costs/km | | Fixed costs/km |
|---|---|---|---|
| | per VKT | per ESAL | |
| Freeways | 1,553 | 6,393 | 11,511 |
| Paved (rural) | | | |
| - busiest 10% | 1,394 | 4,928 | 11,432 |
| - medium-volume 30% | 1,161 | 2,502 | 11,259 |
| - low-volume 60% | 1,123 | 1,609 | 11,676 |

In other words, the proportion of costs which are fixed on each class of road is:

| | Proportion of fixed costs |
|---|---|
| Freeways | 59.1% |
| Paved (rural) | |
| – busiest 10% | 64.4% |
| – medium-volume 30% | 75.4% |
| – low-volume 60% | 81.0% |

The costs per unit of output — arbitrarily dividing the fixed costs by the total kilometres of travel — are as shown in Table E.5.

*Table E.5*
*EXPLORATORY COST ALLOCATION: COSTS PER UNIT OF OUTPUT*
*(1989 $)*

| Road class | Variable costs/km | | Fixed costs/km $ per VKT |
|---|---|---|---|
| | $ per VKT | $ per ESAL | |
| Freeways | 0.0004 | 0.0065 | 0.0026 |
| Paved (rural) | | | |
| – busiest 10% | 0.0005 | 0.0115 | 0.0052 |
| – medium-volume 30% | 0.0011 | 0.0217 | 0.0103 |
| – low-volume 60% | 0.0044 | 0.0599 | 0.0457 |

Administration costs for the whole network amount to $145.7 million annually or $0.0009 per kilometre driven by all traffic.

Costs by vehicle class by road class are shown in Table E.6. These include system-wide bridge and administration costs. The multiplication of these costs and the VKT by vehicle class result in the following allocation of total annual costs:

| | | |
|---|---|---|
| cars | $1,563.1 million | 59.3% |
| small trucks | 393.7 million | 14.9% |
| large trucks | 651.0 million | 24.7% |
| buses | 12.1 million | 0.5% |
| motorcycles, etc. | 10.7 million | 0.4% |
| other | 6.2 million | 0.2% |
| Total | $2,636.9 million | 100.0% |

*Table E.6*

EXPLORATORY COST ALLOCATION: COSTS BY VEHICLE AND ROAD CLASS

(ANNUAL CENTS PER KILOMETRE, 1989 $)

| Road class | Cars | Small trucks | Large trucks | Buses | Motor-cycles | Other |
|---|---|---|---|---|---|---|
| **Variable costs/km** | | | | | | |
| Freeways | 0.06 | 0.07 | 1.52 | 0.20 | 0.04 | 0.23 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.09 | 0.10 | 2.30 | 0.24 | 0.07 | 0.27 |
| – medium-volume 30% | 0.13 | 0.14 | 3.87 | 0.30 | 0.11 | 0.35 |
| – low-volume 60% | 0.46 | 0.47 | 9.93 | 0.71 | 0.44 | 0.79 |
| **Fixed costs** | | | | | | |
| Freeways | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 |
| – medium-volume 30% | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 |
| – low-volume 60% | 4.77 | 4.77 | 4.77 | 4.77 | 4.77 | 4.77 |
| **Total costs** | | | | | | |
| Freeways | 0.53 | 0.53 | 1.98 | 0.67 | 0.50 | 0.69 |
| Paved (rural) | | | | | | |
| – busiest 10% | 0.81 | 0.82 | 3.03 | 0.96 | 0.79 | 1.00 |
| – medium-volume 30% | 1.36 | 1.37 | 5.10 | 1.53 | 1.34 | 1.58 |
| – low-volume 60% | 5.23 | 5.24 | 14.70 | 5.48 | 5.21 | 5.57 |

In addition, there is a further $1.03 billion representing either roads not dealt with here (where, in effect, "costs" means as defined by TAC) or bridge and administration costs not assigned to the paved freeways and rural roads.

It is emphasized that while this methodology attempts to incorporate the best data from Appendix A, the best information available about pavement performance in the Canadian context and the best features of other allocation studies, *more work* is required in testing and refining these procedures before they would be suitable for drawing broad policy implications.

# APPENDIX F: ESTIMATING MARGINAL PAVEMENT COSTS

The OPAC model determines the required strength (structural number which can then be converted to an equivalent granular thickness) for a given number of anticipated ESALs and for a given initial pavement life. For here, a 15-year period is used. As discussed in Section 5, initial pavement life is not critical. Strength requirements are then converted to construction cost estimates based on a cost of \$900/mm for the surface course and \$200/mm for base and sub-base courses. Rather than a continuous function, only a few observations have been calculated as shown in Figure 5.3:

| Annual ESALs | Construction costs (approx. 1989 \$) |
|---:|---:|
| 0 | 70,000 |
| 50,000 | 126,695 |
| 100,000 | 135,204 |
| 250,000 | 148,819 |
| 500,000 | 167,010 |
| 750,000 | 181,458 |
| 1,000,000 | 193,863 |
| 2,000,000 | 214,777 |

From the above, a function has been estimated with a least-squares regression ($n = 8$; $r^2 = 0.802$; and standard errors in parentheses):

$$\begin{aligned} C &= 57{,}686 + 19{,}920 \times \log(\text{ESALs}) \\ &\quad\ (21{,}796) \quad (4{,}043) \end{aligned}$$

To these construction costs, the following resurfacing costs have been assumed (Section 5) with an overlay life of 12 years.

| | |
|---|---|
| 0–250,000 ESALs | = \$55,000 |
| 250,001–1,000,000 ESALs | = \$65,000 |
| over 1,000,000 ESALs | = \$75,000 |

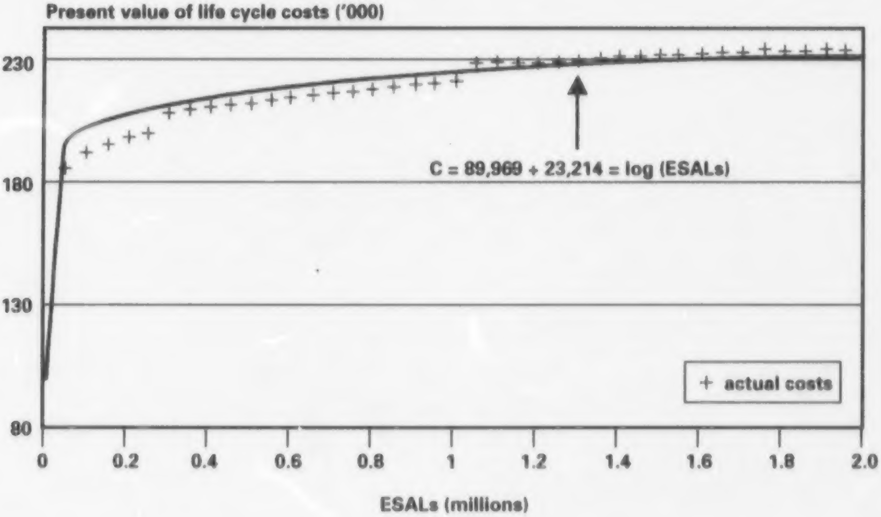
Total life-cycle costs, assuming a time horizon of 39 years, are now estimated as:

$$\text{Life-cycle cost} = C + \frac{R}{(1+r)^{15}} + \frac{R}{(1+r)^{27}}$$

The first term ($C$) is estimated using the construction cost function described above. Life-cycle costs are shown in Figure F.1, with "+" indicating costs estimated using the above equation and with the line showing the costs estimated from a second regression ($n = 41$; $r^2 = 0.965$; and standard errors in parentheses):

$$\underset{(4{,}417)}{C = 89{,}969} + \underset{(703)}{23{,}214} \times \log(\text{ESALs})$$

*Figure F.1*
*LIFE-CYCLE COSTS AS A FUNCTION OF ESALS*



Maintenance costs can be added, given TAC's estimate of $7,743 per kilometre for rural paved highways and the estimate made in Appendix B that 15 percent are related to pavements. However, the addition of the present value of 39 years of an annual expense of $1,161 (15% of $7,743), does not affect the computation of marginal costs. It simply adds a fixed amount to the estimate of life-cycle costs (that is, a fixed amount at any level of annual ESALs); therefore, the derivative with respect to ESALs does not change. What is needed is some way of relating pavement maintenance expenses to the number of ESALs. Since no information on this is available, maintenance expenses are not considered here.

Marginal pavement costs are estimated as follows (and shown in Figure 7.1 in Section 7):

$$MC = \frac{23{,}214}{\text{ESALs}} \times \frac{1}{\ln 10}$$

To put these into perspective, the following shows the marginal pavement costs of the "average" truck with 1.5 ESALs on three classes of rural paved highways (these could also be freeways as the construction costs used here are applicable to both classes of roads).[5]

| Class of road (as measured by annual ESALs) | Marginal pavement cost per ESAL | Marginal pavement cost per truck |
|---|---|---|
| 250,000 | $0.040 | $0.060 |
| 1,000,000 | $0.010 | $0.015 |
| 2,000,000 | $0.005 | $0.008 |

Another way of looking at these marginal pavement costs is to consider several typical (not "average") trucks. These are shown in Table F.1. The first column of the table shows three large trucks as follows:

*Table F.1*

*TYPICAL MARGINAL PAVEMENT COSTS*

| Truck type | Axle loads | Road class | | |
|---|---|---|---|---|
| | a) ESALs<br>b) Canroad<br>c) Waterloo | Low-volume 250K ESALs<br>$0.040/ESAL | Medium-volume 1 million ESALs<br>$0.010/ESAL | High-volume 2 million ESALs<br>$0.005/ESAL |
| | | Cost per truck km | | |
| T3 | a) 2.57 | $0.103 | $0.026 | $0.013 |
| 25 tonne | b) 3.75 | $0.150 | $0.038 | $0.019 |
| | c) 4.88 | $0.195 | $0.049 | $0.024 |
| 3-S2 | a) 3.37 | $0.135 | $0.034 | $0.017 |
| 39 tonne | b) 4.60 | $0.184 | $0.046 | $0.023 |
| | c) 5.84 | $0.234 | $0.058 | $0.029 |
| 3-S3-S2 | a) 4.64 | $0.186 | $0.046 | $0.023 |
| 62 tonne | b) 6.38 | $0.255 | $0.064 | $0.032 |
| | c) 8.28 | $0.331 | $0.083 | $0.041 |

T3 is a three-axle straight truck with a load of 25 tonnes distributed as follows: 7 tonnes on the steering axle, 18 tonnes on the drive tandems. This is a typical truck used for construction work in Eastern Canada (it would have lower axle loads in Western Canada).

3-S2 is a five-axle tractor-semitrailer, the most common large truck configuration in Canada. For the purpose of this illustration, it has been given heavy axle loads. There are some in Eastern Canada occasionally exceeding these limits, but the one used here is known as an RTAC configuration and is allowed to operate coast-to-coast. The axle loads shown are the practical maximum. Total weight is 39 tonnes, distributed as follows: 5 tonnes on the steering axle, 17 tonnes on each of the tandem axles.

3-S3-S2 is an eight-axle B-train, having two trailers and a total weight of 62 tonnes. While there are some slightly heavier than this in Eastern Canada, this is the practical upper limit for the RTAC B-train, which is allowed to operate in all Canadian jurisdictions. Axle loads are: 5 tonnes on the steering axle, 17 tonnes on the tractor's tandem, 23 tonnes on the first trailer's tridem axle, and 17 tonnes on the rear trailer's tandem.

The second column shows load equivalency factors calculated in three ways: (a) the traditional AASHTO ESALs, (b) the Canroad LEFs and (c) Waterloo's LEFs. As shown, the various methods of calculating LEFs have a significant impact on the costs attributed to different trucks. There is one point, however, that is not known. The pavement deterioration models are based on AASHTO's ESALs and, hence, the determination of the functional relationship between life-cycle costs and axle loads is also based on AASHTO's ESALs. The marginal costs shown in Figure 7.1 are marginal costs *per AASHTO ESAL*. It is not clear that these same amounts can actually be used to calculate costs for a truck *where load equivalencies are calculated using the Canroad or Waterloo LEFs*. Even though this is an unknown, the calculations in Table F.1 are based on these procedures simply to illustrate how critical the issue of axle load equivalencies is to the estimate of road costs.

The third, fourth and fifth columns of Table F.1 show marginal pavement costs for rural highways at three levels of traffic. For example, the five-axle tractor-semitrailer incurs a marginal pavement cost of 13.5 cents (low-volume) to 1.7 cents (high-volume) per kilometre, using AASHTO's ESALs. If the Canroad LEFs are used, these costs become 18.4 cents, and 2.3 cents per kilometre. Waterloo's LEFs results in even higher pavement costs for each truck.

## NOTES TO APPENDICES

1. The resulting estimate of 509,381 compares with Statistics Canada's estimate of 276,184 large (RGVW of 16,000 lb or more) "freight" trucks, in *Trucking in Canada*, Catalogue No. 53-222, 1986. These freight trucks do not include "service" or "utility" or "government" trucks.

2. This information is from John Lawson of the Royal Commission staff.

3. In 1988 Ontario conducted another large-scale roadside survey. To date, however, it has not been possible to use this to develop any of the statistics required here.

4. One oversimplification being ignored here is the presence in Ontario of federal roads. Strictly, since these are included in the TAC data, VKT that occur on them should be included in the number produced by multiplying road lengths by AADT. However, since the "error" in the test is to, by default, assume VKT that occur on federal roads in Ontario belong to the "municipal" category, no harm is done.

5. As discussed in subsection A.4, there are concerns about the accuracy of this estimate of 1.5 ESALs per truck, and there could be some question about the suitability of a figure developed on Ontario highways for extensions to all Canadian roads.

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# 13

# ENVIRONMENTAL DAMAGE FROM TRANSPORTATION

VHB Research & Consulting Inc.
March 1992

## SUMMARY

### PURPOSE

The purpose of this document is to assist the Royal Commission in incorporating environmental considerations into its comparison of passenger transport options for Canada.

### SCOPE AND METHOD

The document provides a brief review of the major approaches for assessing environmental impacts associated with transport and for valuing these impacts in economic terms. Based on a review of the published literature, estimates of some of these impacts and their economic value are presented. Opportunities for improving these estimates with additional research are identified.

### STATUS OF THE DATA

This study relies on secondary sources of data. Reasonable estimates of total emissions are available by type and mode, at the point of emission. In general, other environmental effects (for example, impacts caused by transportation emissions) and the environmental effects of vehicle and infrastructure manufacture, maintenance and disposal are not readily available. Some important data for comparing modes, such as loading factors, are not directly available.

The best data for estimating the costs associated with emissions are from studies of environmental damage associated with fossil-fired electricity generating stations. There are a number of differences between the types of emissions, their atmospheric dispersion, and patterns of exposure from power stations and transportation systems that necessitate extreme caution in the application of these economic damage estimates to transportation systems.

The data presented are national averages in the late 1980s, based on published information. The conclusions must be tempered with consideration of possible or likely technological, behavioural or regulatory changes (for example, reduced sulphur content of diesel fuel, rail electrification, more efficient vehicles, higher load factors). Similarly, it must be recognized that variations from the national averages may be very significant in some instances, and these may fundamentally change the order of the various modes in those circumstances.

## MAIN FINDINGS

There is a range of environmental and economic techniques associated with valuing environmental damage that are applicable to estimating damage from intercity passenger transport. The use of the methods for this application, however, has been limited largely to emission inventories and direct damage methods for assigning economic values. Within the scope of this review, specific estimates of environmental damage associated with transportation modes could only be provided for damage associated with vehicle emissions.

The highest value of environmental damage per passenger-kilometre is associated with rail transportation, the lowest with marine transportation, followed by intercity bus transport. For all modes except air transport, most of the damage is associated with human health effects.

## CONCLUSIONS AND RECOMMENDATIONS

The Canadian experience in estimating the social costs of environmental damage is very limited. Evaluations from the United States and Europe should be thoroughly reviewed to assess the applicability of their methods, assumptions and estimates to Canadian conditions. It may be possible to identify studies that could be repeated in Canada, or should be conducted in Canada to fill the most important knowledge gaps left by research elsewhere.

Environmental effects considered in intermodal comparisons are generally limited to vehicle operation. There has been no real attempt to set out the full life-cycle environmental impacts of transportation modes, from raw material extraction through vehicle and infrastructure construction, maintenance and disposal, fuel extraction and processing, and vehicle operation. Broad brush qualitative descriptions have been started for cars, but not for all transportation modes.

Quantitative evaluation of environmental impact assessments of transportation projects or policies is very limited. Greater use of quantitative evaluation could help to indicate some of the local environmental costs, which could be extrapolated for inclusion in the total environmental costs to be considered in transportation policies.

National averages of impacts by mode may obscure significant variations within each mode or significant opportunities that could be pursued. Consideration should be given to evaluation of the environmental impacts of each transportation mode in a multimodal corridor. Windsor to Quebec City or Edmonton to Calgary might be suitable corridors for such a study.

# 1. INTRODUCTION

The Royal Commission on National Passenger Transportation was established to review Canada's intercity passenger transportation system from a comprehensive perspective, looking at all the available modes and their interactions, rather than just one mode at a time.

Environmental considerations are a major concern for future transportation policies. This report is intended to assist the Commission in assessing the relative environmental implications of various modes and to put this assessment in a context that allows the significance of environmental considerations to be compared with other social, technological and policy concerns.

The report consists of six main components:

- a review of methods for assessing the environmental impacts of transportation systems;
- a review of methods for valuing — in economic terms — environmental impacts;
- a summary of published data on environmental impacts of transportation systems;
- a summary of published data on economic values of environmental impacts;
- a consolidation of the impact estimates and their values to estimate the economic value of the environmental impacts of transportation systems; and
- conclusions and recommendations for further research to improve the estimates and their usefulness to the policy-making process.

# 2. METHODS FOR ESTIMATING ENVIRONMENTAL DAMAGE: THEORY AND APPLICATION

## 2.1 THE ENVIRONMENT

A primary decision in determining the environmental effects of passenger transportation, or any other activities, is to decide what constitutes the "environment." There is no universally accepted definition, and the word conveys different meanings to different persons. The dictionary defines "environment" as the "surrounding; surrounding objects, region, or conditions, especially circumstances of life of person or society" (OCD, 1980).

Even where the "environment" is defined in legislation, the word may take on different meanings within different Acts within the same jurisdiction. For example, in Ontario, the *Environmental Protection Act* s.1(1)m is concerned only with the *natural* environment, which means: "the air, land and water, or any combination or part thereof. . . . "

In contrast, the Ontario *Environmental Assessment Act* s.1 provides a very broad definition of environment:

> (a) air, land or water,
>
> (b) plant and animal life, including man,
>
> (c) the social, economic and cultural conditions that influence the life of man or a community,
>
> (d) any building, structure, machine or other device or thing made by man,
>
> (e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man, or
>
> (f) any part or combination of the foregoing and the interrelationships between any two or more of them. . . .

For the purposes of this report, the definition used will fall between these two and is consistent with the definition implicit in the objectives set out in *Canada's Green Plan* (Environment Canada, 1990):[1]

- clean air, water and land;
- sustainable use of renewable resources;
- protection of special spaces and species;
- global environmental security; and
- minimizing the impacts of environmental emergencies.

## 2.2 SOURCES OF ENVIRONMENTAL DAMAGE

### 2.2.1 Resource Use

The use of resources is of particular interest from several perspectives. First, the pattern of use may determine whether the resource is being managed in a sustainable manner. Second, resource use is often correlated with other environmental effects, including air or water pollution, or land-use changes. Often, by altering resource-use patterns, it will be possible to reduce environmental damage significantly.

### 2.2.2 Chemical and Physical Discharges

Some chemicals that are released into the environment as a result of human activities may lead to changes in water, air or soil quality that can result in morbidity or mortality for humans or other species, both plants and animals. These discharges may also damage natural or anthropogenic materials due to their chemical composition.

In addition, discharges may be disruptive even where they are not toxic or corrosive if they lead to physical changes, such as decreased opacity or increased turbidity.

### 2.2.3 Land-Use Changes

Changes in land use may have an impact on the environment by altering the availability of resources, disrupting habitats or migration routes or affecting resource availability.

## 2.3 METHODS FOR ASSESSING IMPACTS

### 2.3.1 Life Cycle Assessment (LCA)

The environmental impacts of an activity may be associated with any stage of the activity, and can only be properly understood — and compared against alternatives — by considering the entire life cycle of the activity, and impacts at each stage of the life cycle. For example, in comparing air emissions associated with electric and diesel trains, it is not sufficient to consider just the emissions from the vehicle, which are higher for the diesel train. One must also consider "upstream" or "indirect" emissions, such as the emissions at the power station where the electricity is generated for the electric train.

In LCAs, the entire life cycle from extraction through material processing, manufacturing, use and disposal or recycling is considered — not just one of these stages. Thus, in the case of an assessment of transportation effects, the effects are not just those associated with operating the vehicle, but also the manufacture of the vehicle, fuel and infrastructure (for example, roads or rail lines), maintenance and disposal. To enable comparisons, these effects are usually considered on a unit basis, such as impact per passenger-kilometre of transportation provided.

Although simple in concept, LCAs are not always easy to implement, and systematic use of quantitative life cycle assessments is limited.[2] Much of the work on life cycle assessment started in the mid-1970s, largely in response to the energy crisis. Some of that early work also considered resource use and environmental discharges. Recently, there has been a renewed interest in LCA, primarily because of concern about waste generation, and many assessments have looked at packaging, diapers and other products associated with waste generation. The methodology for undertaking a life cycle assessment has been described by SETAC (1990), and this approach is becoming widely accepted. It consists of three main stages: inventory, impact analysis and improvement analysis. Much of the focus has been on the inventory stage which quantifies the inputs and outputs from each stage of the life cycle. This is unfortunate because impacts ought to be the basis for comparison, not just resource use and emissions. If one product produces more emissions than another product, but the emissions have no impact because there are no receptors nearby, then the inventory may be misleading as the basis for policy making.

### 2.3.2 Environmental Risk Assessment

Quantitative environmental risk assessment is one method for assessing the impacts of chemical discharges and may be a part of the impact analysis component of an LCA. The objective of risk assessment is to connect specific environmental releases with specific toxicological responses. Quantitative risk assessment involves the following sequence of steps:

- assessment of the exposure of receptors to the discharge (as discharged or as transformed);
- assessment of toxicological data and likely mortality or morbidity implications of the exposure; and
- assessment of individual or population risk.

*Exposure assessment:* Exposure assessment will consider the sources of environmental releases, their pathways through the environment to receptors and the magnitude and duration of exposure:

- Emission patterns: emissions, both routine and occasional, are assessed at each stage in the processing sequence. Quantitative information is needed by contaminant because of different toxicities of different contaminants, by quantity over time because impacts are likely to vary with quantity, and by location to determine how the discharge will move through the environment and who is exposed.

- Environmental fate and transport: once released, discharges move through the environment. They may settle in some component or may be transformed. The environmental fate and transport analysis consider such processes as dispersion and dilution, deposition, bio-accumulation and transformation of compounds. The environmental fate and transport assessment consider the pathways of exposure, for example, the air, water, food and soil concentrations of the contaminants.
- Receptor identification and activity patterns: the exposure assessment considers the receptors, and how much of the discharge, or its transformation product, a receptor is exposed to. Receptors considered are typically humans, though they may be domestic or wild plants, animals or structures subject to material damage. Assessment of their exposure requires consideration not only of environmental pathways, but also activity patterns (for example, the duration of time spent in a location where exposure may occur, and how this time is spent). The dose of atmospheric contaminants will be greater if the receptor is engaged in strenuous physical exercise than if it is resting. It may also require consideration of ambient conditions, as well as the specific release being assessed. The measure of the exposure will vary depending on the toxicological response being considered. Carcinogenic responses are usually assessed based on consideration of total annual exposure, and are typically measured in dose per unit body mass per year; non-cancer chronic exposure may be assessed in terms of mass of contaminant per unit body mass per two week period; and acute exposure may be measured in dose or concentration in air or water (g/kg, or $mg/m^3$).

*Toxicological assessment:* The toxicological assessment considers dose-response curves. Often these will be based on laboratory studies of indicator species, using toxicological models to extrapolate from high to low doses. For some compounds and toxic end points, actual data for some individuals of the receptor species may be available. A critical issue is often the ambient concentrations, that is, how the specific source under consideration contributes to the total concentration. This is particularly significant for toxic effects which only occur when a threshold is exceeded.

*Risk assessment:* Finally, the estimated exposure and the dose-response curves may be combined, and the impact of the discharges on morbidity or mortality assessed. Typically the risks are expressed as a probability of morbidity or mortality occurring, and may be given for an individual, or for the entire population exposed.

#### 2.3.3 Ecological Analysis

Resource use is addressed in life-cycle assessments. Air, land and water quality, and environmental emergencies, at least as they affect biological species, may be addressed through environmental risk assessment.[3] However, environmental risk assessment is directed primarily at individuals, and their physiological health as a result of chemical exposures. Ecological analysis considers population, community or ecosystem effects emerging from cumulative effects on individuals, and from a consideration of other ecological factors, such as habitat supply after land-use changes. For example, risk assessment might identify effects of an environmental release on individuals of a certain species, but the ecological analysis would review how these individual effects affect the population and how these population changes might affect other species and the ecosystem as a whole.

For example, the effects on biological communities of filling a marsh to construct a highway would be addressed through an ecological analysis, as would greenhouse gas impacts and ozone depletion.

### 2.4 EVALUATION OF ALTERNATIVES

Once impacts are identified, it is probable that one alternative (that is, transportation mode) will have lower impacts of some types and higher impacts of other types. Evaluation methods are required to determine which is best overall in a given context. A wide variety of evaluation methods are available (VHB, 1990); the next section considers economic approaches for valuing different types of impacts, thereby enabling evaluation using economic measures.

## 3. METHODS FOR EVALUATING THE SOCIAL COSTS OF ENVIRONMENTAL DAMAGE: THEORY AND APPLICATIONS

### 3.1 THE ECONOMIC APPROACH TO EVALUATION

The economic approach to evaluation is based on the premise that evaluation takes place whenever a person is confronted by a choice among two or more mutually incompatible alternatives. In such a situation, choosing one of the alternatives requires foregoing whatever could have been attained by choosing any of the other alternatives instead. Economists assume that the alternative chosen by the person in such a situation must be the one the person values most highly. Indeed, such a choice involves an implicit cost of foregoing the next most highly valued alternative, which economists call the "opportunity cost." Thus, if someone chooses to drive to a destination rather than to take a bus, then for that person the net value of driving (the value of the speed, convenience and other valued factors over the cost) must exceed the net value of taking the bus.[4] If taking the bus was the next most preferred alternative to driving, then the net value of taking the bus (perhaps including valued factors such as a more relaxed trip) would be the opportunity cost of driving instead of taking the bus.

This kind of choice occurs whenever we purchase something, or refrain from purchasing something. Purchasing something requires giving up a certain amount of money and thus *foregoing* whatever else could have been purchased with that money. If one refrains from making a purchase, one is implicitly deciding that greater value could be achieved by saving that money to spend on something else. This is the kind of expression of preferences that applies to commodities and services that can be bought and sold in a market. The economic approach to evaluation suggests that, in order to have a unified approach to evaluation *both* for goods and services that are provided through markets *and* for goods and services available outside markets (for example, environmental amenities), the same kind of evaluative procedure should apply to both.

### 3.1.1 Willingness to Pay and Willingness to Accept

The relationship between value and money provides the economist with a quantitative basis for evaluation: the value of something to a person who does not already have it is the maximum amount of money the person would be willing to pay (WTP) to attain it. Conversely, the value of something already enjoyed by a person is the minimum amount the person would be willing to accept (WTA) to give it up. By either of these different measures of value, the monetary value a person assigns to something will depend on that person's overall assets, including money. Furthermore, people will often assign WTA values several times greater than their WTP values for the same items. Thus a person's economic evaluation of something will depend on the person's position with regard to ownership of assets in general and of the thing under evaluation in particular.

Given individual monetary evaluations, social value can be most easily computed as the sum of these value assignments. The relative preferences of each person would not count equally in such a social value; rather, each person's preferences would be weighted in proportion to total personal assets or wealth. As a basis for public policy decisions, this social value appears to be at odds with the democratic principle of "one person, one vote." To make social value more in accord with the latter principle, individual evaluations could be weighted to reflect what each person would be willing to pay *if* their incomes were equalized. One crude procedure for this is to apply weights to each person's monetary evaluations inversely proportional to their incomes or wealth (Pearce, 1983). More precisely, it can be shown that this condition is better reflected if the inverse is raised to the power of the person's income elasticity of demand for the good in question (Pearce, 1983). In considering institutional changes that allocate or reallocate rights, it is not only effects by income class that may be important. Bromley (1991, p. 226) observes that "significant progress on air and water pollution turns critically on the distribution (incidence) of different kinds of benefits and costs, not just by income class, but by job category, by location of residence, by education level, and by a number of variables rarely pondered in economic analysis."

These considerations about the appropriate basis for evaluation bear particularly on the evaluation of public goods, including many environmental services (for example, air for breathing and for carrying away exhaust fumes), the allocations of which are public (political) decisions. Who holds rights to which services (to emit exhaust fumes or to breathe free of exhaust fumes[5])? Accordingly, in determining people's values for environmental services, is the correct measure WTP or WTA? Furthermore, are the correct measures of social value based only on people's monetary assets, or on their total assets (including their non-monetary shares of environmental services) or on what they would be if income or assets were equalized?

All of these general considerations with regard to evaluation apply to evaluation of the social costs of environmental damage, including environmental damage from passenger transportation. From an economic perspective, the general problem of environmental damage is that use of one environmental service (for example, air for carrying away exhaust fumes) can alter the environment and reduce the benefits (or impose costs) from use of the same or another environmental service (for example, air for breathing) by someone else or by society at large.[6] There are thus "external costs" from the first use for the second use. Of course, even to refer to "environmental damage" and "external costs" assigns some presumptive rights to the second use.

The most immediate form of environmental damage is damage to our health. In economic terms, health is treated just as any other service. Given an initial endowment of health and other assets, the cost of a loss in health is equivalent to the minimum amount of compensation the person would have required in order to have suffered the loss voluntarily. If other people also suffer a loss from a reduction in health of the person, then the total cost should also include compensation for their losses. There are several types of loss, including direct monetary costs as well as losses in well-being, that bear consideration with regard to compensation: "(1) medical expenses associated with pollution-induced diseases, including the opportunity cost of time spent in obtaining treatment; (2) lost wages; (3) defensive or averting expenditures associated with attempts to prevent pollution-induced disease; (4) disutility associated with the symptoms and lost opportunities for leisure activities; and (5) changes in life expectancy or risk of premature death" (Cropper and Freeman, 1991, p. 166).

Similarly, with environmental damage in the form of damage to natural resources (including crops) and materials, the cost of the loss is equivalent to the minimum amount required to compensate for the loss in the quantity or quality of the products or services derived from these resources or materials.

## 3.2 TYPES OF VALUE

### 3.2.1 Direct Use Value

In the case of cultural artifacts and environmental amenities, there are several aspects of value to be considered. This discussion has referred mainly to the value that can be derived from immediate uses, or direct use value, of goods and services (including environmental services). In referring to environmental amenities, it is often necessary to be careful about what constitutes "use." The value of such amenities often derives not only from direct experience, but also indirect experience through literature, photographs, films and television. This type of value is sometimes distinguished as "vicarious use value."

### 3.2.2 Option Value

Economists also recognize that goods and services can have kinds of value other than their immediate use value. Even if people do not currently use a good or service, if the future supply (availability) of the good or service is uncertain, they might be willing to pay to secure the option to purchase the good or service in the future. Similarly, even if future supply is not an issue, they might be uncertain about whether they want to purchase and use a good or service in the future, and hence might be willing to pay to maintain that option. The types of value implicit in this willingness to pay are referred to by economists as "supply option value" and "demand option value" respectively.

### 3.2.3 Quasi-Option Value

A somewhat related, but distinct, type of value applies in the case of actions toward the environment which are expected to have irreversible, but uncertain consequences, and where the uncertainty over the consequences could be resolved over time. For example, there might be uncertainty about the benefits that could be derived from preservation of an ecosystem that would be irreversibly harmed by a particular project. Then there is a value, which economists call "quasi-option value," in maintaining options for future use while more complete knowledge is obtained.

### 3.2.4 Existence Value

Apart from willingness to pay for present and possible future use of environmental amenities, people may be willing to pay just to secure the existence of an environmental amenity (for example, wildlife in a particular area), whether or not they expect to experience it directly or indirectly. Economists refer to this kind of willingness to pay as "existence value." Furthermore, people may be willing to pay for the existence of these amenities not only for themselves, but also for their progeny and future generations. This kind of willingness to pay is sometimes referred to as "bequest value."

In practice, it is often very difficult to know whether people really distinguish among vicarious use value, existence value and bequest value conceptually or in their behaviour. Thus, these three forms of value are often subsumed under a more general concept of existence value; this is the practice that will be followed here.

### 3.2.5 Summary

Economists have recognized three general types of value that make up people's willingness to pay (or to accept payment) for non-marketed environmental amenities: use value, option value and existence value. Consequently, the social costs of environmental damage can be measured in terms of losses in these values.

It is apparent that the economic approach to evaluation places exclusive weight on the values people attach to things relative to the value they place on their other assets: how much of their other assets they would be willing to forego to obtain a valued item, or how much they would have to be compensated to be willing to give up a valued item. This approach can be challenged in several regards. First, it is clear that it is a strictly anthropocentric basis for evaluation. On the other hand, it is difficult to conceive of a method of evaluation that is not anthropocentric. Nevertheless, a basis of evaluation that is not anthropocentric would seem to be implied by the "biocentric" world views offered by advocates of "deep ecology" (Devall and Sessions, 1985; Naess, 1989). According to such world views, the validity of an evaluation is not derived merely from human volition, but rather is subject to broader ecological criteria. Second and furthermore, the economic approach to evaluation depends substantially on people's knowledge in making evaluations of environmental services, although even scientists are often unsure about the importance of ecosystem components and functions. As remarked by Costanza (1991, p. 336), "[t]he public is most likely far from being fully informed about the ecosystem's true contribution to their own well-being, and they may therefore be unable to directly value the ecosystem's services."

Mindful of these limitations, the strength of the economic approach to evaluation is that it tries to provide an indication of people's "true" preferences in the aggregate (in terms of the maximum they would be willing to give up, and the minimum they would have to be compensated), given the current distribution of assets (and liabilities). One may question whether the status quo is an appropriate basis for social evaluation, and doubt whether people are sufficiently informed or entitled to make evaluations of ecosystems and their services, but nevertheless believe that this measure of value provides useful information to consider in economic and environmental policy making. In any case, it should not be forgotten that it is also incomplete and potentially misleading information, unless it is supplemented by other information, such as economic information on the incidence of costs and benefits, and ecological information on the sustainability of environmental uses. The need for this supplementary information should be borne in mind in interpreting the information on social costs provided here.

## 3.3 METHODS FOR ASSESSING BENEFITS AND COSTS

The economic benefits and costs of any change in a person's situation fall into two categories:

- gains and losses to their monetary assets (or assets sold for money); and
- increases or decreases in their non-monetary wealth or well-being.

### 3.3.1 Direct Cost Assessment

The benefit or cost of a change of the first category can be taken to be just the monetary value of the assets, because compensation for the benefit or cost could be made simply by restoring the monetary assets of the person to the initial situation. Some of the costs of environmental damage can be considered as this kind of direct cost.[7] Care must be taken where the damage is sufficiently widespread to affect prices. In this case, costs, and the distribution of costs, will be determined by the market response to the loss incurred by the damage.

This subsection is mainly concerned with methods for evaluating changes of the second category. All of these methods are direct or indirect ways of determining the values people assign to changes in their non-monetary wealth or well-being, usually in terms of WTP for improvements or for avoiding losses, and sometimes in terms of WTA losses. One of the practical problems with these methods is that they can often be applied only to indicate WTP. However, if rights are initially assigned on the basis of prior use or non-destructive use, for example, then the appropriate measure of value is the WTA of the bearers of those rights (Krutilla and Fisher, 1985). Until recently, it was commonly assumed by economists that WTP and WTA should be equivalent, so that a measure of WTP could be substituted for WTA where required. This was based on the assumption that value functions are "smooth," that is, there are no abrupt changes in marginal value according to quantity consumed. As already indicated, there is now substantial evidence that WTA is often several times greater than WTP in common situations (Knetsch and Sinden, 1984; Knetsch, 1984). This suggests that value functions are often "kinked" at some "reference quantity," which is usually the quantity currently consumed.

There are three main methods for evaluating well-being:

- household production function (HPF) methods;
- hedonic methods; and
- contingent valuation methods (CVM).

The first two methods are indirect ways of assessing preferences by inference from market behaviour: these are said to be "revealed preferences" indicated by observable behaviour. The third method determines preferences directly by surveys with interviews.

Two other methods of evaluation for environmental costs are mooted:

- costs necessary to meet national targets for emission reductions; and
- costs implicit in previous decisions or mitigation measures.

Both methods are based on the premise that evaluations already reached through the policy process are a more appropriate guide to further policy development than individual evaluations. There is an apparent circularity in these methods, in that evaluation appears to become immune from any criteria external to the policy process. Nevertheless, it might be maintained that these methods take better account of some of the considerations concerning the incidence of costs and benefits and the sustainability of the environmental uses broached at the end of the previous section. To avoid the circularity of the policy-based methods, these considerations could be taken into account explicitly. For example, if "no net loss" of "natural capital" (Pearce and Turner, 1990) is adopted in policy as a basic condition and commitment of sustainability, a "sustainability premium" (ibid.) could be added to the values determined by the previous methods to ensure this condition.

### 3.3.2 Household Production Function (HPF) Methods

HPF methods are based on the observation that many goods and services bought by consumers are only intermediate products that households use as inputs into their own production processes to produce goods and services for final consumption. This "household production" also draws on environmental conditions. In particular, there is a strong relation between household expenditures on some goods and services and the use of environmental amenities or avoidance of environmental disamenities. The amounts households are willing to pay for marketed goods and services can thus be used to infer evaluations of environmental amenities and disamenities.

HPF methods usually consider one particular good or service, and assume that prices for that good or service for each household are established already. Given these prices, the HPF method applies to observations of which households purchase the good or service, and in what quantities.

The HPF method used the longest and most extensively is the travel-cost method (TCM) for evaluating recreational sites. In this method, the "prices" that distinguish among households are the costs of travelling to the recreational site, with higher costs generally associated with greater distances from the site.

Recently, the HPF method has also been used for the evaluation of factors affecting health by recording defensive or averting behaviour. For example, frequencies of visits to doctors and purchases of water filters and household detectors or tests for naturally occurring radioactive radon gas have been used to assess knowledge and evaluations of associated health effects (Smith, 1991). In the case of emissions from transportation, if the purchase of air conditioners, especially car air conditioners, could be considered, at least in part, defensive expenditures to filter air, then this method might apply. Of course, there would immediately be a problem of how to attribute expenditures on air conditioning between air filtering and air cooling.

Practical applications of HPF methods generally require restrictive, simplifying assumptions about the factors that determine purchase decisions. The data requirements of these methods grow exponentially with the number of factors under consideration.

### 3.3.3 Hedonic Methods

Like HPF methods, hedonic methods depend on hypothesized relationships between purchases of marketed goods and services, and evaluations of related environmental amenities or disamenities. In this case the marketed good is often real estate (usually residential property or agricultural land) and sometimes labour.

In hedonic methods (sometimes called hedonic price methods), prices are functions of numerous factors, including environmental factors. For example, it might be hypothesized that residential property prices are related to environmental amenities in the area. If so, this price information can be used to infer values (willingness to pay) for these amenities. For example, houses near an airport affected by noise might sell for less than comparable houses not near the airport, reflecting some of the costs people attribute to the noise.

Similarly, if it is hypothesized that people are willing to work for lower wages in locations with higher environmental amenities, this should be reflected in wage rates, and the value people assign to these amenities can be inferred from wage rates.

Although hedonic methods are straightforward in principle, there are several practical difficulties in applying them. The main difficulties are likely to be in producing statistically significant results, when environmental amenities may only constitute a few minor factors among a large number of other factors which affect prices. In the case of residential properties, in particular, the characteristics of the properties and their neighbourhoods, as well as the accessibility to transportation and work locations, are likely to be factors of greater, or at least equal, importance than environmental amenities. Furthermore, there might not be substantial differences in some environmental amenities *within* the geographic extent that can be identified with a particular residential property market. Differences in other factors could raise difficulties for comparisons between markets.

Another difficulty in applying hedonic methods is making assumptions about the mathematical relationships between prices and the characteristics of relevance in determining price. The more general the starting assumptions, the more data will be required to specify the mathematical relationships. Data requirements are likely to be the greatest difficulty in applying hedonic methods, especially where there is a need to assess demand (willingness to pay) over a wide range of environmental quality. Nevertheless, there have been a number of notable demonstrations of hedonic methods, and progress is being made in refining the methods for easier and more reliable application (Palmquist, 1991; Pearce and Markandya, 1989; Cropper and Oates, 1990).

### 3.3.4 Contingent Valuation Methods

Contingent valuation methods (CVM) use survey questionnaires to ask people their WTP or WTA for particular benefits or losses. Sometimes, people are asked to indicate a max[illegible]alue in dollars, or to select a maximum value from a range of values. M[illegible]ften, they are asked if they would be willing to pay a given amount: if they accept, the amount is raised; if they decline, the amount is lowered, until the maximum amount they are willing to pay is determined. Sometimes, the interviewer indicates verbally or with a chart the amounts paid for similar benefits for comparison.

A study conducted in Berlin in the mid-1980s (Schulz, 1985 as reported in Schulz and Schulz, 1991) is an example of an application of the CVM method to evaluating urban air quality. Residents of Berlin were surveyed to determine their willingness-to-pay for each of four kinds of air quality: Berlin air (where air quality may warrant a smog alarm); big city air (where air quality does not warrant a smog alarm); small town air; and vacation spot or holiday resort air. Further, respondents, through their answers to several questions, were classified according to their knowledge about air pollution and its effects. When the results of this survey were extrapolated for the whole Federal Republic of Germany at that time (population approximately 60 million), the estimated benefit was DM14 billion (approximately CAN$160 per capita) per annum for improvement of air quality to small town air quality, and DM30 billion (approximately CAN$350 per capita) per annum for improvement to the standard of vacation spot/resort air quality. If corrections were made for the "information deficits" of less informed respondents, these willingness-to-pay estimates increased to DM28 billion (CAN$320 per capita) per annum and DM48 billion (CAN$560 per capita) per annum respectively.

Many economists were originally very skeptical whether the CVM method could produce useful information because of the number and magnitude of the biases that can affect results. The different kinds of potential bias have been extensively catalogued and reviewed by Mitchell and Carson (1989). For example, simple applications of the method might be open to a kind of "strategic bias," whereby respondents would give values higher than their actual WTP, in the expectation that this might help to secure the benefit, and believing they would not actually be required to pay in proportion to the value they indicate. If the application of the method includes actual payment (perhaps from an initial fixed "gift"), then respondents might indicate a value lower than their actual WTP, in the belief that their stated value would have little effect on securing the benefit, so that the expected value of a high bid is small compared with the value of limiting their payment.

In any attempt to assess WTA for a loss after the loss has occurred, strategic bias is a problem. It is only somewhat less of a problem before the loss has occurred. Thus, CVM, like the other methods, appears to be most readily applicable to assessing WTP. This is still a problem in using these methods to assess the social costs of environmental damage.

There are many other potential sources of bias in CVM (Pearce and Turner, 1990; Carson, 1991; Mitchell and Carson, 1989). Nevertheless, substantial progress has been made, especially in the last decade, in developing ways of testing for and controlling these biases (Carson, 1991; Mitchell and Carson, 1989). As a result, CVM is now more commonly applied and accepted. It also has the great advantage of often being the only method that can be used to assess all the types of values, not just the use and option values.

In spite of the advances in developing CVM, application design still requires great sophistication to produce reliable results. CVM questionnaires generally require numerous questions to characterize and check the validity of the evaluation responses; sampling and analysis procedures can also be quite complex. Although CVM is gaining acceptance among economists, it is perhaps the method with the furthest to go in winning acceptance outside the profession.

## 3.4 APPLICATION OF EVALUATION METHODS TO ENVIRONMENTAL DAMAGE

Not all the social costs of environmental damage can be measured by each of the evaluation methods. Table 1 indicates which of the methods might apply to each type of social cost mentioned in subsection 3.1.

The "direct costs" of environmental damage apply where there is a direct monetary ("out-of-pocket") loss from the damage. As shown in the table, this would be the case with medical expenses, lost wages, defensive or averting expenditures, costs of material repair, and loss of the natural resource productivity. Of course, in each case, there will be different degrees of difficulty in establishing the causal relationship between the purported agent of environmental damage and the loss.

*Table 1*

APPLICABILITY OF EVALUATION METHODS TO THE SOCIAL COSTS OF ENVIRONMENTAL DAMAGE

| | | **Direct cost** | **Defensive/ averting behaviour method** | **Travel cost method** | **Hedonic** | **Contingent valuation method** |
|---|---|---|---|---|---|---|
| Health and comfort | medical expenses (incl. opportunity cost of time) | • | • | | • | |
| | lost wages | • | • | | • | |
| | defensive or averting expenditures | • | • | | • | |
| | disutility of symptoms and lost leisure | | • | | • | • |
| | changes in life expectancy and risk of death | | • | | • | • |
| Material damage | cost of repair/replacement/cleaning | • | • | | | |
| | loss of cultural heritage — use value | | • | • | | • |
| | loss of cultural heritage — option value | | • | | | • |
| | loss of cultural heritage — existence value | | • | | | • |
| Natural environment | loss of natural resource productivity | • | • | | | |
| | loss of natural amenities — use value | | • | • | • | • |
| | loss of natural amenities — option value | | • | | • | • |
| | loss of natural amenities — existence value | | • | | | • |

With regard to HPF methods, the averting behaviour method could, in principle, apply to all the costs, if suitable averting behaviours could be identified for each. In practice, the averting behaviour method has been applied most readily to health effects. In all cases, it should be noted that this method provides only *ex ante* WTP of people's expectations of costs.

It might be argued that it is *ex post* WTA that is likely to be more relevant for the purposes of policy making.

Also among HPF methods, the travel cost method applies to the use values of cultural artifacts and natural amenities. To use the travel cost method for the evaluation of environmental damage, it would be necessary to apply the method before and after the damage occurs, or have multiple "equivalent" alternatives differing only in environmental quality.

The hedonic methods are most likely to be applicable to health damage and reductions in the use and option values of natural amenities in residential areas. In principle, both the wage rate method and the residential property price method could be applied to all these values. In practice, the wage rate method has been applied to the evaluation of workplace health risks, and the residential property price method has been applied to the evaluation of use and option values of environmental amenities in residential areas. The hedonic method could also be applied to evaluate the costs of environmental damage to agricultural land, using agricultural land prices.

In principle, the contingent valuation method could apply to all costs, but it would usually be inappropriate to use it to solicit hypothetical evaluations of direct costs where actual data about these costs can be obtained. If care is taken to avoid "double-counting" (that is, including the same value twice), then the different value or costs can be added to give total values and costs.

Many economists favour research designs in which two or more evaluation methods are applied to the same object of value, in order to compare results among the methods.

## 4. ENVIRONMENTAL DAMAGE

As was indicated in Section 2 there are three aspects of environmental damage to be considered:

- changes in resource requirements, which can be measured using life-cycle analysis techniques;
- changes in physical and chemical discharges, measured by environmental risk assessment techniques; and

- changes in land-use patterns, generally expressed in terms of changes in habitat availability or "ecological analysis."

Though research has focussed on environmental risk assessment because of its direct applicability in determining toxicity to humans and morbidity, all three aspects are necessary if a complete assessment of environmental damage is to be developed. There is a connection between the three types of damage: changes in physical and chemical discharges can often be traced to changes in the processing and use of resources, and physical and chemical discharges alter resource quality which can affect habitat availability. As a result, the techniques cannot be looked at in isolation. They must be examined as a system, with the data coming out of one method of assessment feeding into another method of assessment.

Procuring all the data required for each type of assessment is difficult. Nevertheless, it is possible to draw some conclusions from the available data. Only some of the data will be directly applicable to valuing the damage. This section presents the quantitative and qualitative data which are to be considered in the valuation of the damage attributable to each mode of transport.

## 4.1 DAMAGE DUE TO CHANGES IN RESOURCE REQUIREMENTS

Resource use is associated with three types of environmental damage: the impact of emissions released during the extraction of resources, the effect of resource extraction on land-use patterns and the reduction in resource capital.

The loss of resource capital is not directly damaging to the environment; rather it is the implication of resource extraction to long term sustainable development which is of concern. Such damage can be expressed in terms of the rate of capital depletion and the potential for resource substitution.

This subsection outlines the resource use associated with the manufacture of transport vehicles and the infrastructure required for their operation as well as the operation of vehicles.

*Vehicle manufacture:* Resources are required at each stage of manufacturing including:

- the extraction of natural resources;

- the processing of natural resources into final materials;
- parts assembly; and
- vehicle assembly.

A complete inventory of resource use, emissions and waste for each stage cannot be compiled as data are often unavailable, or aggregated to a level where they are no longer representative of individual processes (VHB, 1991c). Assembling a series of comparable data for different transport vehicles is further complicated by inconsistent monitoring and reporting procedures.

Of all the resources under consideration, energy-use data are most readily available. Energy-use data can be assembled for the manufacture of the four basic materials used in transport vehicles — steel, aluminum, rigid plastic and glass.

Where energy data are disaggregated by fuel type, air emissions can be estimated using emission factors.[8] Emissions from vehicle manufacture averaged over the lifetime of the vehicle should be added to emissions from vehicle operation.

*Construction and maintenance of infrastructure:* Resource use and emissions from the construction and maintenance of roads and depots also contribute to the environmental damage from transportation. Table 2 shows the approximate amount of energy used to make the asphalt and lay one kilometre of a four-lane (two lanes x two directions) highway. Note that the values do not include the energy contained within the tar of the asphalt, the energy required to prepare the ground for paving or the energy required to manufacture and distribute street furniture, such as safety barriers.

The energy used to construct one kilometre of highway is about 32 GJ. However this requirement is negligible when compared to the energy required by the road vehicles using the same length of highway.

*Table 2*
ENERGY REQUIRED TO PAVE ROADWAYS

| Task | Energy use/km | Notes |
|---|---|---|
| pavement manufacture | 2,000 MJ | 4,000 tonnes of asphalt required per km of 4-lane highway (personal communication with Bayne Potapchuk, D. Crupi and Sons, Scarborough)<br>approximately 0.5 MJ/tonne asphalt (Brown 1985) |
| pavement laying | 10,400 to 30,800 MJ | 270 to 800 tonnes oil equivalent (OECD, 1988)<br>1 tonne = 1.17 ML crude (LeBlanc, 1992)<br>1 ML crude = 38.51 TJ (Statistics Canada, Catalogue No. 57-003) |

*Fuel manufacture and distribution:* The environmental impacts of oil refineries are numerous. Air pollutants released in large quantities include sulphur dioxide, hydrocarbons, nitrogen oxides, carbon monoxide and particulates. Conventional contaminants measured in process effluents include total organic carbon, dissolved organic carbon, ammonia, nitrogen, total and volatile suspended solids, sulphides, phosphorous, oil and grease, phenolics and pH. Benzene, ethylbenzene, toluene, and xylene have been detected in significant amounts in refineries. Chromium and zinc have also been found in high levels in the effluent. In addition, oil refineries produce potentially toxic wastes consisting of sludges from effluent treatment, spent catalysts and tars (VHB and Canviro, 1991).

Gasoline has a high vapour pressure compared to other liquid transportation fuels. This pressure, in combination with the large volume of gasoline used in the transportation sector, means that gasoline distribution and marketing accounts for about 10 percent of the total hydrocarbon emissions in Canada (Table 3). These emissions arise due to:

- the escape of vapour during storage and transfer of fuel between the refinery and retail stations; and
- leakage during vehicle refuelling at the gasoline pump (Transport Canada and Environment Canada, 1989).

Table 3

## 1985 EMISSION INVENTORY IN CANADA (KILOTONNES)

| Source | $CO_2$[b] (kt) | % | $SO_2$ (kt)[e] | % | $NO_x$ (kt) | % | HC[a] (kt) | % | PM[c] (kt) | % | CO (kt) | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motorcycles | 192 | <0.01 | 47 | 1.2 | 1 | 0.1 | 4 | 0.2 |  |  | 15 | 0.1 |
| Passenger cars | 52,547 | 12.1 |  |  | 392 | 20.0 | 471 | 26.2 |  |  | 4,016 | 37.2 |
| Light-duty trucks | 10,509 | 2.4 |  |  | 74 | 3.8 | 115 | 6.4 |  |  | 850 | 7.9 |
| Medium-duty trucks | 7,813 | 1.8 |  |  | 54 | 2.7 | 78 | 4.3 | 1 | 0.1 | 570 | 5.3 |
| Heavy-duty trucks | 27,075 | 6.2 |  |  | 286 | 14.6 | 64 | 3.5 | 22 | 1.0 | 436 | 4.0 |
| Air | 12,271 | 2.8 | f |  | 34 | 1.7 | 10 | 0.6 |  |  | 117 | 1.1 |
| Marine | 5,219 | 1.2 | 17 | 0.4 | 17 | 0.9 | 28 | 1.6 |  |  | 85 | 0.8 |
| Rail | 3,145 | 0.7 | 18 | 0.5 | 138 | 7.0 | 10 | 0.6 | 6 | 0.3 | 48 | 0.4 |
| Transportation total | 118,771 | 27.3 | 82 | 2.2 | 994 | 50.7 | 780 | 43.4 | 29 | 1.3 | 6,135 | 56.9 |
| **Total all sources** | **435,180** | **100** | **3,800[e]** | **100** | **1,959** | **100** | **1,798** | **100** | **2,200[d]** | **100** | **10,780** | **100** |

**Source:** **Transport Canada, 1989; OECD, 1991; SENES Consultants, 1991.**

**Notes:** **Blanks indicate data not available.**

- a **Non-methane**
- b **1987 fossil fuel only**
- c **Diesel only**
- d **Total particulate from all sources**
- e **3,800 kt for late 1980s (OECD, 1991); $SO_2$ distribution from SENES Consultants (1991)**
- f **Included in rail**

The development of alternative fuels has long been seen as a desirable measure to reduce the transportation sector's dependence on fossil fuels.

Electric cars are considered by some to be the most promising of alternative vehicles, with prototypes being tested by the major North American car manufacturers. Though these cars have no exhaust emissions, pollutants are released during the generation of electricity, particularly the emissions associated with coal-fired generating plants. The risks associated with nuclear plants should also be considered when determining the total environmental costs of electricity-powered vehicles.

*Operation and Maintenance:* The disposal of hazardous or potentially hazardous components of transport vehicles may also result in significant environmental damage. Car batteries contain cadmium, mercury and lead which are released as the battery corrodes. Batteries are to be deposited in special hazardous waste landfills which are designed to contain the hazardous materials. However, leaks from such landfills are common.

Coolants used in the air conditioning systems of transport vehicles contain CFC-12 which is known to cause ozone depletion and is thought to contribute to global warming. Although coolants can be refined and recycled on-site, only some service stations offer this service.

Spent motor oil contains organic contaminants such as PCBs, benzene and toluene. It may also contain some lead. Traditionally, waste oil has been used as a dust suppressant on unpaved roads, reused or released to sewer systems or non-hazardous landfills. Because of its potentially hazardous qualities, Ontario recently banned the use of motor oil as a dust suppressant. Waste oil can easily be recycled, and many service stations offer this service.

Used tires when improperly stored are inflammable, as exemplified by the recent used-tire fire in Hagersville. Recycling can only absorb a small fraction of the tires generated. Although tires can be burned for use as an energy source, this has been banned in some jurisdictions due to concerns over the emissions from combustion. Because of the high cost of landfill disposal, tires are often illegally dumped or stored in unsafe piles (Pilorusso, VHB and T.A.G., 1990).

## 4.2 DAMAGE DUE TO CHANGES IN PHYSICAL AND CHEMICAL DISCHARGES

This section provides a detailed explanation of environmental risk assessment including:

- identification of discharges;
- estimation of pollutant loading;
- a description of the fate of those discharges and some of the secondary effects associated with them;
- an assessment of the receptors which are exposed to those discharges and what the level of exposure might be;
- a review of the toxicological data and implications of exposure; and
- an assessment of the individuals or populations at risk.

As indicated in the last section, discharges include emissions to water and air resources as well as the disposal of solid hazardous and non-hazardous waste. Discharges can be attributed to the manufacture and operation of transport vehicles as well as the construction and maintenance of the transportation infrastructure.

An assessment of the risk associated with physical and chemical discharges should include all these sources of pollution. Research, however, has focussed on air emissions from the operation of transport vehicles, and data on the type and extent of emissions from other aspects of transportation are, in general, not available. As a result, the examples in the discussion focus on atmospheric discharges from vehicles since these data are most readily available.

### 4.2.1 Identification of Discharges

The emissions of major concern are:

- hydrocarbons (HC)
- oxides of nitrogen ($NO_x$)

- carbon monoxide (CO)
- carbon dioxide ($CO_2$)
- particulates, sulphur dioxide ($SO_2$)
- chlorofluorocarbons (CFCs).

Other more toxic compounds (heavy metals such as cadmium or lead) are of concern in particular instances.

*Hydrocarbons:* Hydrocarbons (HC) are the volatile portion of unburned hydrocarbons (fuel) emitted from vehicle engines. The main sources of unburned hydrocarbons are exhaust gases and evaporative losses from engines and during refuelling.

Private passenger motor vehicles account for more than 75 percent of HC from transportation sources. The transportation sector as a whole accounts for about 43 percent of HC emissions from all anthropogenic sources (Table 3).

Exposure to hydrocarbons has been shown to cause skin irritation and has also been linked to the increased incidence of leukemia in the vicinity of large point sources (OECD, 1988). The ecological impact of hydrocarbon emissions, however, is most apparent in their contribution to the creation of ozone during reaction with nitrogen oxides and sunlight.

*Oxides of nitrogen:* The major source of $NO_x$ is the burning of diesel in the internal combustion engine. The transportation sector is the major contributor — about one half of total $NO_x$ emissions from all sources in Canada.

Nitrous oxides result in human respiratory and circulatory ailments, vegetative effects, material damage to textiles, fabrics, plastics and rubber, and impaired visibility. Nitrous oxides are also a precursor of low level ozone, and contribute to ozone layer depletion, global warming and acid deposition (VHB, 1991b).

*Carbon monoxide:* Carbon monoxide (CO) is a by-product of the combustion of fossil fuels. Private passenger motor vehicles account for about 80 percent of CO emissions from transportation sectors. Just over one half of total CO emissions in Canada originate from transportation sources (Table 3).

Elevated CO levels cause a number of adverse effects on human respiratory and cardiovascular systems. Carbon monoxide is also a contributor to the creation of low level ozone, which affects human health and damage vegetation and materials. It is a radiative gas contributing to global warming (VHB, 1991b).

*Carbon dioxide:* Carbon dioxide ($CO_2$) is a by-product of the burning of fossil fuels. The transportation sector accounts for about one quarter of total $CO_2$ emissions in Canada (Table 3). Carbon dioxide does not pose a risk to humans, materials or ecosystems directly but is a major anthropogenic contribution to global warming which could damage human health, ecosystems and materials.

*Particulates:* Particulate (aerosol) emissions are a significant portion of diesel exhaust. Only a small amount of total diesel particulate emissions in Canada arise from the transportation sector. Aerosol particulate consists of approximately 75 percent carbon (soot) and 25 percent polycyclic aromatic hydrocarbons (PAHs) (VHB, 1991b). Soot is a major cause of smog. A number of PAHs found in diesel particulate are known or suspected carcinogens and mutagens.

Particulate fibres from the transportation sector also result from the wearing of brake linings and tires containing asbestos (OECD, 1988). Asbestos fibres may cause respiratory and cardiovascular problems in humans.

Visibility may be limited due to haze, and fabrics and surfaces may be discoloured due to the settling of particulates on exposed surfaces.

*Sulphur Dioxide:* Sulphur dioxide ($SO_2$) emissions from the transportation sector arise from the burning of fossil fuels and account for only about 2 percent of total $SO_2$ emissions in Canada. Sulphur is present in diesel fuel. Sulphur dioxide causes adverse respiratory problems and contributes to acid rain which indirectly affects health by increasing the risk of mercury or lead poisoning or intoxication from other elements in the environment. Acid deposition onto certain watersheds also damage the aquatic system through altering the pH level of the water. Sulphur dioxide emissions can also result in materials damage and decreased visibility.

The sulphur content of diesel fuel determines the quantity of particulate emissions emitted by diesel engines. High sulphur content appears to increase the organic soluble fraction of the particulate matter (Pilorusso, 1986). As particulate emissions from diesel engines are reduced, sulphur becomes a larger portion of total particulate emissions. Engine manufacturers and fuel producers in the United States have agreed that engines designed to meet particulate emission standards must have less than 0.05 percent sulphur content in diesel fuel (Transport Canada and Environment Canada, 1989). The result will be a further lessening of sulphur emissions from the transportation sector.

*Chlorofluorocarbons:* Chlorofluorocarbons, specifically CFC-12, are used as blowing agents and coolants in air conditioning systems and, CFC-11, in the production of foam padding and seats. The transportation sector is a small user of total chlorofluorocarbons. These synthetic chemicals contribute to stratospheric ozone depletion, and may contribute to global warming (IPCC, 1990).

### 4.2.2 Estimation of Loading

Baseline emissions of these contaminants in Canada are presented in Table 3. The transportation sector accounts for between 25 and 30 percent of all $CO_2$ emissions in Canada. Transportation is not a major contributor to $SO_2$ and particulate emissions — about 2 percent and 1 percent respectively of total estimated emissions in Canada. About one half of all $NO_x$, hydrocarbon and CO emissions in the country originate from the transportation sector. The relative contribution of each transportation mode to the emission of each contaminant of concern is also presented in Table 3. The major source of emissions in the transportation sector is the operation of passenger motor vehicles, except for $SO_2$, where heavy duty trucks, air, marine and rail modes of transport are the greatest sources of emissions.

Table 4 presents the estimated operating energy use and air emissions of major contaminants by mode of passenger transportation on a unit basis. Energy efficiency data are fleet averages unless otherwise stated. The data reflect the differences in vehicle occupancy between the various modes of passenger transport and provide a standard for comparison.

*Table 4*

**ENERGY USE AND EMISSIONS BY MODE OF TRANSPORTATION**[a]

| Transport mode | Fuel type | Energy use (MJ/pass-km) | | Carbon dioxide (g/pass-km) | | Sulphur dioxide (g/pass-km) | | Nitrous oxides (g/pass-km) | | Hydrocarbons (g/pass-km) | | Particulates (g/pass-km) | | Carbon monoxide (g/pass-km) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High |
| Intercity bus transport | Diesel | 0.52$^{b}$ | 0.94$^{h}$ | 36.75 | 66.70 | 0.06 | 0.11 | 0.50$^{b}$ | 0.86 | 0.07 | 0.10 | 0.03 | 0.05 | 0.21$^{b}$ | 0.40 |
| Motor vehicles | Gasoline | 1.70$^{b}$ | 1.72 | 115.55 | 116.91 | 0.14 | 0.14 | 0.62$^{c}$ | 0.78$^{e}$ | 0.78$^{e}$ | 0.97$^{e}$ | 0.58 | 0.58 | 3.67$^{e}$ | 5.81$^{e}$ |
| Air transport | Turbine gas | 2.00$^{b}$ | 4.59h | 141.66 | 325.18 | 0.01 | 0.02 | 0.09 | 0.80$^{b}$ | 0.06$^{b}$ | 0.17 | 0.004 | 0.01 | 0.07$^{b}$ | 0.34 |
| Railroad transport (VIA only) | Diesel | 1.73$^{h}$ | 3.28$^{c}$ | 122.28 | 232.03 | 0.20 | 0.37 | 2.47$^{g}$ | 4.73 | 0.12 | 0.64$^{b}$ | 0.07$^{b}$ | 0.26 | 0.10$^{g}$ | 1.87 |
| Marine transport | Fuel oil | 0.11 | 0.25 | 8.97 | 20.40 | 0.08 | 0.19 | 0.01 | 0.03 | 0.001 | 0.003 | 0.003 | 0.01 | 0.04 | 0.09 |

**Sources:** **Environment Canada, 1991. Transportation Systems Division. Khan, 1990. Statistics Canada, 1986. *Railway Transport in Canada, General Statistics, 1985*. Statistics Canada, 1990a. *Canadian Civil Aviation, 1989*. Statistics Canada,1990b. *Passenger Bus and Urban Transit Statistics, 1988*. Statistics Canada, 1990c. *Railway Operating Statistics 69*; 12. Statistics Canada, 1990d. *Shipping in Canada, 1989*. VHB Research and Consulting Inc., 1991. Royal Commission on National Passenger Transportation, 1991.**

**Notes:**

| | |
|---|---|
| a | **Based on 1989 energy use (Statistics Canada, 1986; 1990a; 1990b; 1990c; 1990d and 1989 emissions coefficients VHB, 1991), unless otherwise stated.** |
| b | **Khan, 1990.** |
| c | **Statistics Canada (1986; 1990c).** |
| d | **Based on estimated passenger-kilometres RCNPT (1991), Statistics Canada (1990d) and VHB (1991).** |
| e | **Environment Canada (1991). Transportation Systems Division, Mobile 4 base case emissions, Ontario. Low estimate is for highway light-duty gasoline vehicle, high estimate for light-duty gasoline truck. Assumes 1.8 passengers per vehicle.** |
| f | **Intercity bus data are for 1988.** |
| g | **Based on fuel efficiency and emission factors for California passenger trains (Khan, 1990).** |
| h | **VHB (1991) estimate of energy use for 1988.** |

The greatest amount of energy used on a passenger-kilometre basis (pass-km) is from the operation of passenger air service, between 2.00 and 4.59 MJ/pass-km. Rail service is the second largest energy user per passenger-kilometre, 1.73 to 3.28 MJ/pass-km. Marine transport is the most fuel efficient requiring only 0.11 to 0.25 MJ/pass-km. Intercity bus travel is the second most fuel efficient mode of passenger transport demanding 0.52 to 0.94 MJ/pass-km. Passenger motor vehicles required about 1.70 MJ/pass-km, in 1989.[9]

Emissions of each pollutant per passenger-kilometre are also presented in Table 4. The highest emission rate of $CO_2$ is from air and rail passenger transportation (between 140 and 325 g/pass-km and between 122 and 232 g/pass-km, respectively). The least amount of $CO_2$ is emitted from marine transport, between 9 and 20 g/pass-km. Passenger motor vehicles emit about 116 g/pass-km of $CO_2$ and intercity buses between 37 and 67 g/pass-km.

On a passenger-kilometre basis, the predominant source of $SO_2$ is passenger rail transportation, emitting 0.2 to 0.4 g/pass-km. The other modes emit less $SO_2$, about 0.02 g/pass-km from air transport, 0.06 to 0.11 g/pass-km from intercity bus, 0.14 g/pass-km from passenger motor vehicles and between 0.1 and 0.2 g/pass-km from marine vessels.

The major source of $NO_x$ is rail transport, 2.5 to 4.7 g/pass-km. Private passenger motor vehicles emit between 0.6 and 0.8 g/pass-km and intercity bus transportation between 0.5 and 0.9 g/pass-km. Nitrous oxides emissions from air range greatly, between 0.1 and 0.8 g/pass-km and emissions from marine transport are small, between 0.01 and 0.03 g/pass-km.

Passenger motor vehicles emit between 0.8 and 1.0 g/pass-km of HC. The remaining modes of transport emit less. Air transport emits between 0.1 and 0.2 g/pass-km and rail transport between 0.1 and 0.6 g/pass-km. Intercity bus transportation emits about 0.1 g/pass-km. Emissions of HC from marine transport are negligible.

The highest emissions of particulates are from passenger motor vehicles, about 0.6 g/pass-km. Rail transport emits between 0.1 and 0.3 g/pass-km and intercity bus transport about 0.04 g/pass-km. Air and marine transport emit negligible amounts of particulates.

Private passenger motor vehicles are the largest contributor of CO emitting between 3.7 and 5.8 g/pass-km. Rail transportation emits between 0.1 and 1.9 g/pass-km. Carbon monoxide emissions from air transport vary between 0.1 and 0.3 g/pass-km, and from intercity bus transport emissions vary between 0.2 and 0.4 g/pass-km. Marine passenger transportation emits between 0.04 and 0.1 g/pass-km.

Detailed data on generation of HC, CO and $NO_x$ for different types of private passenger motor vehicles are presented in Tables 5, 6 and 7. The data indicate the range of pollutant emissions possible. The difference in gasoline emission rates between provinces reflects differences in provincial fuel vapour-pressure standards (personal communication, François Terrillon, Environment Canada). Emissions also reflect the differences in season, climate, type of fuel used and age and maintenance of the vehicle. This does not permit the easy estimation of a national emissions factor. Diesel emissions do not vary significantly between jurisdictions, reflecting the insensitivity of diesel fuel to many of the factors which affect gasoline emissions.

*Table 5*

*HIGHWAY HYDROCARBON EMISSIONS BY PROVINCE, 1989*

*(G/PASS-KM)*

| Province | Light-duty gasoline vehicle | Light-duty gasoline truck | Light-duty diesel vehicle | Light-duty diesel truck | Motorcycles |
|---|---|---|---|---|---|
| British Columbia | 1.05 | 0.97 | 0.13 | 0.17 | 1.59 |
| Alberta | 0.94 | 0.96 | 0.13 | 0.17 | 1.72 |
| Saskatchewan | 0.97 | 1.03 | 0.13 | 0.17 | 1.99 |
| Manitoba | 1.02 | 1.03 | 0.13 | 0.17 | 1.97 |
| Ontario | 0.69 | 0.97 | 0.12 | 0.17 | 2.13 |
| Quebec | 0.63 | 0.97 | 0.12 | 0.17 | 2.02 |
| New Brunswick | 0.59 | 0.89 | 0.11 | 0.17 | 1.55 |
| Nova Scotia | 0.66 | 0.93 | 0.12 | 0.17 | 1.78 |
| Newfoundland | 0.67 | 0.93 | 0.12 | 0.17 | 1.68 |

**Source:** **Environment Canada, 1991. Transportation Systems Division.**

**Note:** **Assumes 1.8 passengers per vehicle.**

### *Table 6*

## *HIGHWAY CARBON MONOXIDE EMISSIONS BY PROVINCE, 1989*
## *(G/PASS-KM)*

| Province | Light-duty gasoline vehicle | Light-duty gasoline truck | Light-duty diesel vehicle | Light-duty diesel truck | Motorcycles |
|---|---|---|---|---|---|
| British Columbia | 6.25 | 5.50 | 0.28 | 0.31 | 6.32 |
| Alberta | 5.95 | 6.20 | 0.28 | 0.31 | 6.42 |
| Saskatchewan | 5.98 | 6.56 | 0.28 | 0.31 | 6.15 |
| Manitoba | 6.37 | 6.53 | 0.28 | 0.31 | 6.12 |
| Ontario | 3.67 | 5.81 | 0.27 | 0.31 | 6.00 |
| Quebec | 3.37 | 6.03 | 0.27 | 0.31 | 6.00 |
| New Brunswick | 3.33 | 6.03 | 0.27 | 0.31 | 6.44 |
| Nova Scotia | 3.61 | 5.94 | 0.27 | 0.31 | 6.14 |
| Newfoundland | 3.68 | 6.09 | 0.27 | 0.31 | 6.27 |

**Source: Environment Canada, 1991. Transportation Systems Division.**

**Note: Assumes 1.8 passengers per vehicle.**

### *Table 7*

## *HIGHWAY NITROGEN OXIDES EMISSIONS BY PROVINCE, 1989*
## *(G/PASS-KM)*

| Province | Light-duty gasoline vehicle | Light-duty gasoline truck | Light-duty diesel vehicle | Light-duty diesel truck | Motorcycles |
|---|---|---|---|---|---|
| British Columbia | 0.90 | 0.77 | 0.50 | 0.57 | 0.73 |
| Alberta | 0.85 | 0.80 | 0.50 | 0.57 | 0.73 |
| Saskatchewan | 0.84 | 0.81 | 0.50 | 0.57 | 0.72 |
| Manitoba | 0.87 | 0.81 | 0.50 | 0.57 | 0.71 |
| Ontario | 0.62 | 0.78 | 0.50 | 0.57 | 0.71 |
| Quebec | 0.58 | 0.79 | 0.49 | 0.57 | 0.71 |
| New Brunswick | 0.59 | 0.80 | 0.49 | 0.57 | 0.74 |
| Nova Scotia | 0.62 | 0.79 | 0.49 | 0.57 | 0.71 |
| Newfoundland | 0.63 | 0.79 | 0.50 | 0.57 | 0.73 |

**Source: Environment Canada, 1991, Transportation Systems Division.**

**Note: Assumes 1.8 passengers per vehicle.**

The light-duty gasoline motor vehicle emissions for HC, CO and $NO_x$ given in Table 4 are based on emission factors provided in Tables 5, 6 and 7 for Ontario — the province having the largest proportion of passenger cars registered in Canada.

*Limitations of estimates:* The emissions data presented in Table 4 are approximations of the expected emissions of each pollutant by transportation mode. It is difficult to estimate a "typical" set of emission factors for any pollutant or mode of transport — age and composition of the vehicle, vehicle fuel efficiency, level of vehicle maintenance, climatic conditions, regulatory standards across jurisdictions, vehicle speed, emissions control technology, vehicle occupancy, fuel vapour pressure and combustion chamber design, all affect emission rates.

Pollutant emissions on a g/pass-km basis also vary based on the occupancy of the transportation vehicle. For example, if the $NO_x$ emissions presented in Table 4 — 4.7 g/pass-km — are for a passenger rail car at 25 percent occupancy then the $NO_x$ emissions for the rail car at 50 percent occupancy would fall to 2.4 g/pass-km. As such, the range of emission factors presented in Table 4 implicitly embody a fixed level of occupancy per vehicle for each mode of transportation.

### 4.2.3 Estimation of the Environmental Fate of Discharges

After discharge, pollutants may react with other compounds in the environment leading to forms of environmental damage other than those associated with direct deposition. This environmental damage is often referred to as indirect or secondary effects of emissions, though the potential damage caused by those secondary effects may be much more significant than those caused by direct discharge. Secondary damage of concern includes:

- global warming from the emission of greenhouse gases;
- stratospheric ozone depletion;
- the formation of tropospheric ozone or photochemical smog; and
- acid deposition.

Table 8 indicates the individual pollutants from transportation that contribute to these potential causes of environmental damage.

*Table 8*

SECONDARY EFFECTS OF ATMOSPHERIC POLLUTANTS FROM THE TRANSPORTATION SECTOR

| **Pollutant** | **Global warming** | **Ozone depletion** | **Photo chemical smog** | **Acid deposition** |
|---|---|---|---|---|
| Carbon dioxide | ● | | | |
| Carbon monoxide | | | ● | |
| Nitrogen oxides | ●[a] | | ●[a] | ● |
| Chlorofluorocarbons | ● | ● | | |
| Ozone[b] | ● | | ● | |
| Sulphur oxides | | | | ● |
| Hydrocarbons | ●[a] | | ●[a] | |

**Source: Barakat and Chamberlin, 1990.**

**Notes:**

**a Ozone is formed in the atmosphere from $NO_x$, HCs, water vapour ($H_2O$) and sunshine. $NO_x$ concentrations are believed to be the determinant of the rate of ozone formation.**

**b Ozone is not emitted but the transportation sector is a major contributor of the principal precursors, $NO_x$ and HCs.**

*Global warming:*[10] The transportation sector produces greenhouse gases through the combustion of fossil fuels. These gases, primarily $CO_2$, contribute to global warming. In addition, air conditioners and foam padding in transport vehicles may emit CFC-12 which is also a greenhouse gas.

The Earth's atmosphere has a limited capacity to absorb gaseous wastes and the emissions of greenhouse gases from man-made sources may change the world's ecosystems and radically alter the world's climate (Ottinger et al., 1990, p. 127).

Many of the gases emitted by the transportation sector, including $CO_2$, $CH_4$, $N_2O$, $O_3$ and CFCs,[11] absorb the infrared radiation (heat). Heat is reradiated back onto the Earth's surface, rather than into space, causing the temperature of the Earth's surface to rise. There is scientific consensus that increases in greenhouse gas emission will result in climate change (IPCC, 1990). Although the nature and extent of the change, as well as its ramifications for human well-being, are uncertain.

*Stratospheric ozone depletion:* The transportation sector emits pollutants which contribute to stratospheric ozone depletion. Of concern are chlorofluorcarbons used in air conditioning systems and foam cushioning. The destruction of the stratospheric ozone layer permits an increased amount of ultraviolet radiation to reach the Earth's surface, which may result in human health, crop, forest and materials degradation.

*Acid deposition:* Acid rain is caused by emissions of $SO_2$ and $NO_x$. Once released into the atmosphere, these substances can be carried long distances by the prevailing winds, and return to Earth in acidic forms as rain, snow, fog or dust. Environmental damage occurs if the acid precipitation cannot be neutralized.

The main sources of $SO_2$ emissions in Canada are coal-fired power generating stations and industry (non-ferrous ore smelters); the transportation sector contributes a minor amount, about 2 percent of total emissions. The main sources of $NO_x$ emissions, however, are motor vehicles through the combustion of fossil fuels.

Acid rain leads to the acidification of lakes and streams. In some cases aquatic life is depleted. Acid deposition on a watershed causes an increase in the aluminum concentration of freshwater bodies within that watershed; aluminum is more toxic to some aquatic biota than is acidity.

Increases in the acidity of soil, water and shallow ground water are also suspected of causing forest and vegetation damage. Acid rain damages buildings and monuments, and is suspected of causing respiratory illness in humans.

*Ozone:* Observed for decades in urban areas, ozone is now found in rural areas, especially in the summer (OECD, 1991). Both nitrogen oxides and hydrocarbons contribute to the creation of ozone. The transportation sector, particularly private motor vehicles, is a major source of these pollutants.

The environmental damage caused by ozone includes loss of agricultural crop productivity, human respiratory problems and materials soiling and degrading.

### 4.2.4 Assessment of the Exposure of Receptors to Discharges

As pollutants move away from the emission source they may be deposited or diluted. They may also break down. Very few data are available on the dispersion patterns and concentrations of pollutants emitted on transportation routes, but impacts can be expected to diminish with distance.

Table 9 shows the dispersion of lead and zinc emitted from road vehicle exhausts. The data in the table indicate that concentration of lead decreases with distance from the road edge.

Dispersion patterns and concentrations of gaseous pollutants depend upon meteorological conditions and can be modelled using computer simulations. Of all possible road situations, rural highways are the easiest to model because the background levels of some pollutants are relatively low when compared to areas where there is a dense road network.

Most models are based on observed data for CO. CO is the easiest gaseous transportation pollutant to model because transportation is the predominant source of this type of emission, and the effect of background concentration is relatively unpronounced.

*Table 9*

*DISPERSION OF LEAD AND ZINC EMISSIONS FROM ROAD EDGE*

| | Lead concentration (ppm, d.w.) | | | | Zinc concentration (ppm, d.w.) | | | |
|---|---|---|---|---|---|---|---|---|
| **Distance from road edge (m)** | **Road A 50,000** | **Road B 18,500** | **Road C 16,000** | **Road D 3,000** | **Road A 50,000** | **Road B 18,500** | **Road C 16,000** | **Road D 3,000** |
| 0 | 3,045 | 858 | 1,075 | 465 | 880 | 422 | 272 | 106 |
| 1 | 2,813 | 402 | 457 | 118 | 700 | 198 | 167 | 69 |
| 5 | 342 | 177 | 136 | 32 | 144 | 122 | 79 | 75 |
| 15 | 223 | 75 | 163 | 26 | 150 | 55 | 92 | 59 |
| 30 | — | 45 | 63 | 26 | — | 63 | — | 65 |
| 50 | 223 | 45 | 95 | 38 | 95 | 69 | 58 | 64 |
| 100 | — | — | 60 | 21 | — | — | 76 | 78 |
| Background | 14 | | | | 60 | | | |

**Source: Freedman (1989) modified from Dale and Freedman (1982).**

The rate of fall-off for gaseous pollutants is very rapid. There is little difference in the fall-off rates for each of the gaseous transportation pollutants (personal communication with Rob Bloxam). There are some complications in the modelling of nitrogen oxides due to chemical conversions which take place during transport. Particulate fall-out is particularly difficult to model due to the abundance of sources in the background.

### 4.2.5 Assessment of Toxicological Data and Likely Mortality or Morbidity Implications of Exposure

*Human health:* Atmospheric pollutants can cause adverse health effects varying from short- term illnesses (morbidity) to death (mortality). In the transportation sector the pollutants which pose the greatest health risk are $NO_x$, $SO_2$, $O_3$, $H_2SO_4$ and $HNO_3$. Table 10 presents the expected health effects for the major pollutants associated with the transportation system.

*Table 10*
*HEALTH EFFECTS BY TYPE OF EMISSION*

| **Pollutant** | **Health effects** |
|---|---|
| Sulphur dioxide | • respiratory illness for people sensitive to asthma and bronchitis |
| Carbon monoxide | • interferes with red blood cells and the ability of the body to absorb oxygen<br>• lowers worker productivity<br>• impairs nervous system, coordination, vision, judgement<br>• exacerbates cardiovascular disease symptoms (angina, etc.)<br>• affects the fetus, young children and sickle cell anemics (lower birth rates and increased mortality)<br>• works with other air pollutants to promote morbidity through respiratory and circulatory ailments |
| Nitrous oxide | • lowers ability of lung to function properly; irritation, emphysema<br>• respiratory problems, coughing, runny noses, sore throat in children<br>• works with other air pollutants to promote morbidity through respiratory and circulatory ailments |
| Hydrocarbons | • leukemia, mutagens and carcinogens<br>• skin irritation |
| Particulate matter | • respiratory problems<br>• infant mortality and total mortality in urban areas — bronchitis, asthmatics and cardiovascular patients (already ill)<br>• asbestos (lung cancer, asbestosis, mesothelioma — cancer of lung linings and abdomen) |
| Ozone | • damage to membranes of the respiratory system<br>• respiratory distress<br>• eye irritation |

**Sources: OECD, 1988; Freedman, 1989.**

*Terrestrial Biota:* The transportation emissions which are of primary concern for terrestrial ecosystems are nitrogen oxides. Nitrogen oxides affect terrestrial ecosystems through a number of pathways:

- direct fumigation or deposition on the plant;
- the development of photochemical oxidants (specifically ozone) arising from the reaction of $NO_x$ and hydrocarbons with sunlight; and
- through the combination of $NO_x$ with atmospheric water to form acid deposition.

The primary impact pathways of transportation related to airborne emissions on terrestrial systems (and the pollutants corresponding with each of these) are as follows:

- foliar damage due to fumigation ($SO_2$, $O_3$, $NO_x$);
- foliar damage due to deposition ($SO_2$, $H_4SO_4$, $HNO_3$);
- long-term accumulations in soil ($H_2SO_4$, $HNO_3$); and
- physiological stress on livestock and wildlife ($SO_2$, $O_3$, $NO_x$).

Although there is a great deal of concern regarding the effects of these pollutants on forest resources, the body of scientific evidence which links specific ambient levels of pollutants to forest damage is meagre. There are a number of reasons for this paucity of information:

- Short duration events are often obscured.

  Pollutant dose is often expressed as a function of the pollutant concentration. This dose-response technique assumes a normal distribution of ambient pollutant concentration over time. Hourly pollutant concentrations (such as, ozone) often vary greatly. Acute effects of periodic short-term high-pollutant concentrations typically differ greatly from chronic effects resulting from long-term exposure (Concord Environmental and VHB, 1991). Standard pollutant exposure estimation techniques tend to underestimate impacts.

- There is a lack of correlation between the findings of laboratory impact assessments and actual changes in yield.

  Many scientific experiments are designed to detect changes to the morphology and physiology of plants. In most cases, however, these changes have not been correlated with changes in yield. This gap severely hampers the use of these results for policy analysis.

Furthermore, observations made in controlled conditions often do not accurately depict what will happen in the natural environment. Opponents to more stringent controls often cite this failure to demonstrate damage under "real world" conditions as a principal argument against tighter regulations (Concord Environmental and VHB, 1991).

- General observations of terrestrial damage have not been validated.

  Validation of the applicability of laboratory results to "real world" conditions can be achieved either through empirical studies or through the development of mechanistic models. The effect of ozone on forest resources is a good example of the difficulty in achieving adequate validation. Although forest decline has been carefully monitored in many locations strict dose-response relationships cannot be developed due to the inherent variability in environmental conditions and the potential for a myriad of factors contributing to the observed response in varying degrees and means (Concord Environmental and VHB, 1991).

These limitations of our scientific understanding pervade the environmental impact literature and are inescapable. Comments do not suggest that the scientific literature should not be used to the greatest extent possible; instead, they suggest caution in their interpretation and the need to be vigilant in recognizing the inherent variability and complexity in the interactions and impacts described.

*Forest resources:* Although there have been numerous studies on seedling response to nitrogen oxides, ozone, and acid precipitation (Mohnen, 1989; Peterson et al., 1989; Reich et al., 1989; Percy, 1986; Jensen and Patton, 1990; Chappelka and Chevone, 1989), little is known about the effect of these pollutants on mature trees. Most of the dose-response studies use changes in seedling growth as a surrogate for mature trees due to seedling size and manageability. Unfortunately, a quantitative link between the surrogate indicator and the yield has not been developed. Filling in these gaps is crucial if the data provided are to be effectively used in determining the effects of transportation emissions on forest resources. The absence of specific dose-yield response curves for valued resources does not imply that years of research are necessary before these can be produced. Undoubtedly, more research can and should be conducted. Expert judgement and logic can be used to fill in the gaps as an interim measure. This is an essential step for effective policy analysis.

Table 11 summarizes the availability of data relating exposure levels to forest damage.

*Table 11*
SUMMARY OF THE AVAILABILITY OF DATA RELATING EXPOSURE LEVELS TO FOREST DAMAGE

| **Species** | **Pathway** | **Pollutant** | **Dose-yield available** | **Dose-surrogate response available** |
|---|---|---|---|---|
| coniferous trees | fumigation on plant | nitrogen oxides | NAPAP concludes, "$NO_x$ at ambient concentrations is not a direct source of regional scale growth reductions in U.S. forests."[a] | no |
| | | photochemical oxidants | no | Both losses and gains of above ground biomass of Pinus taeda in response to ozone exposure are evident and no definitive trend can be discerned. |
| | | dry acid deposition | no | no |
| | deposition on plant | $NO_x$ | no | Visible foliar injury of red spruce increases with an increase in nitrogen mists.<br>Data is provided in kg/ha/yr; however, such spatial deposition has been determined for only a few sites in Canada. |
| | | acid rain | no | Significant decreases in germination and seedling survival are observed only when the pH of rainfall is below 3.6. This level of acidity is generally not encountered in ambient rainfall. (Significant damage can occur at high elevations (acid fog).) |
| | deposition on soil | | no | no (Most significant impacts: change in Al availability; depletion of Ca and Mg.) |
| deciduous trees | fumigation | $NO_x$ | NAPAP concludes that "$NO_x$ at ambient concentrations is not a direct source of regional scale growth reductions in U.S. forests."[a] | no |

*Table 11 (cont'd)*

SUMMARY OF THE AVAILABILITY OF DATA RELATING EXPOSURE LEVELS TO FOREST DAMAGE

| Species | Pathway | Pollutant | Dose-yield available | Dose-surrogate response available |
|---|---|---|---|---|
| deciduous trees (cont'd) | | photo-chemical oxidants | no | Studies on the effects of ambient ozone on deciduous seedlings have rendered mixed results. (Recent studies looking at the combined effects of ozone and acid rain have rendered mixed results.) |
| | | dry acid deposition | no | no |
| | deposition on plant | nitrogen oxides | no | no |
| | | acid rain | no | No significant reductions in germination and seedling survival are recorded until pH < 3.6, well below observed ambient rainfall |
| | deposition on soil | | no | no (Most significant impacts: change in Al availability; depletion of Ca and Mg; acidity of soil.) |

**Source: Concord Environmental and VHB, 1991.**

**Note:**

**a U.S. Environmental Protection Agency, National Acid Precipitation Assessment Program ("State of Science & Technology" Series), *Changes in Forest Health and Productivity in the United States of America*, prepared by J.E. Barnard and A.A. Lucier, 1989.**

*Agricultural Resources:* The effect of ozone on yield has been well documented in recent years through the USEPA's National Crop Loss Assessment Network (NCLAN). Figures 1, 2, 3 and 4 show dose-response curves developed for a variety of row and cereal crop species. Losses in yield can occur at well below concentrations observed in Canadian urban areas (see Figure 5). The effect of ozone on fruit species has not been documented.

Nitrogen oxides are not thought to cause significant damage to crops. Very high concentrations (>4 ppm of $NO_2$ for 10 hours) are required for leaf injury to occur. These concentrations are well above concentrations observed in

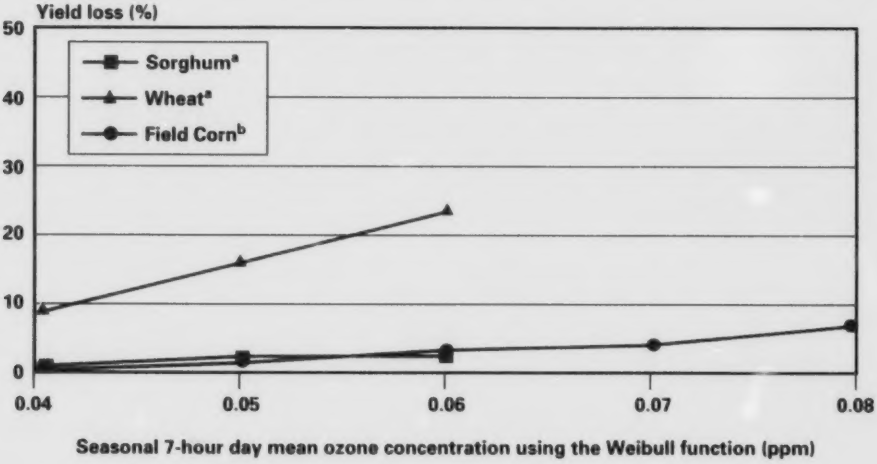
Canadian urban areas (see Figure 6). In low concentrations, nitrogen dioxides should be accounted for as a source of the necessary nitrogen requirements of plant materials. The fertilizer effect has been observed in a number of studies (Heck, 1989; Lesser et al., 1989; Phytotoxicology Consulting Services, 1989; Victor and Burrell, 1982; DPA, 1987).

Crops exposed to simulated acidic precipitation under controlled conditions showed either no effect on growth or yield, or mixed results at ambient levels. Normal agricultural practices of liming generally prevent nutrient or soil acidification, although the additional costs to ameliorate these effects should be included as part of the impact assessment (Victor and Burrell, 1982). Figures 7 through 14 provide dose-response functions for various cereal, row and fruit crops.

Table 12 summarizes the availability of data relating exposure levels to crop damage.

*Figure 1*

*THE EFFECT OF OZONE ON CEREAL CROP YIELD (7-HOUR MEAN)*

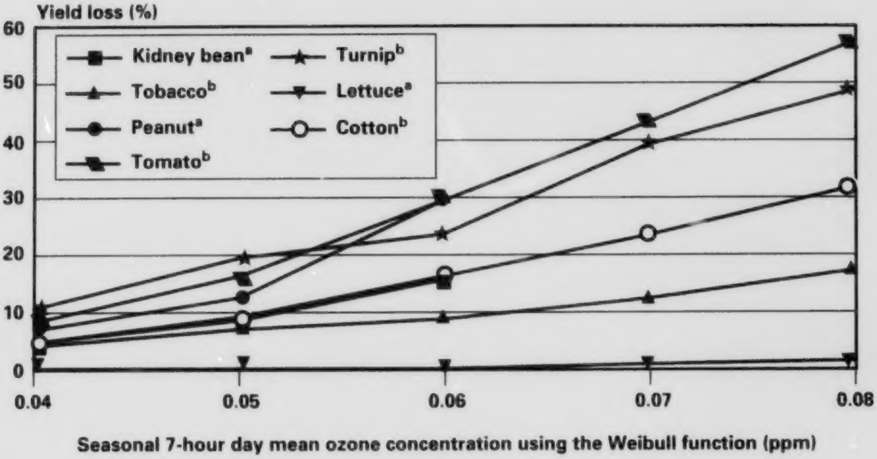


a Lesser et al., 1989

b Heck et al., 1988

*Figure 2*

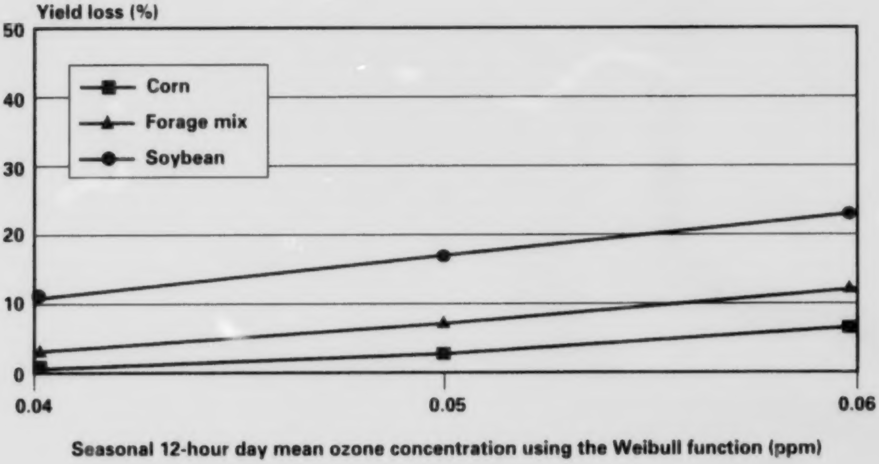
## THE EFFECT OF OZONE ON ROW CROP YIELD (7-HOUR MEAN)



a Lesser et al., 1989
b Heck et al., 1988

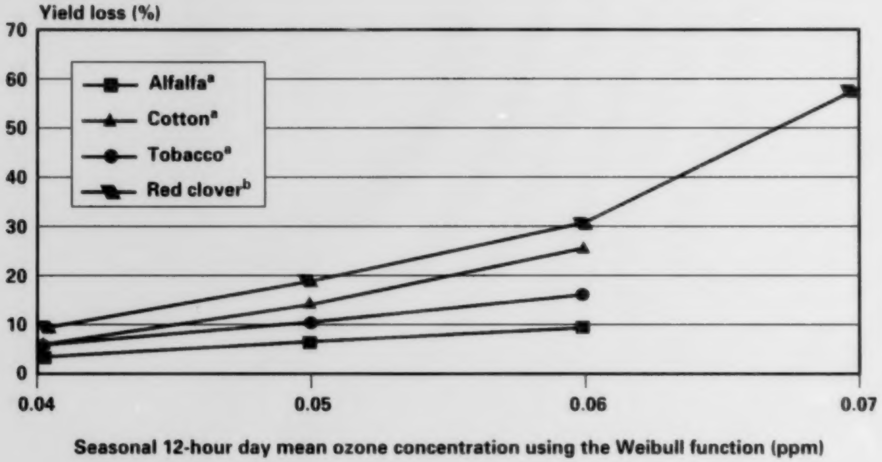
*Figure 3*

## THE EFFECT OF OZONE ON CEREAL CROP YIELD (12-HOUR MEAN)



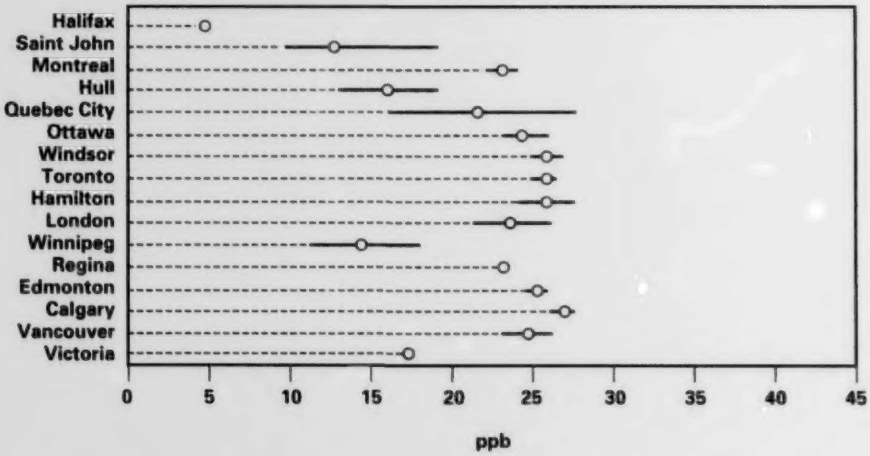
Source: Lesser et al., 1989

### Figure 4
### The Effect of Ozone on Row Crop Yield (12-Hour Mean)



a Lesser et al., 1989
b Heck et al., 1988

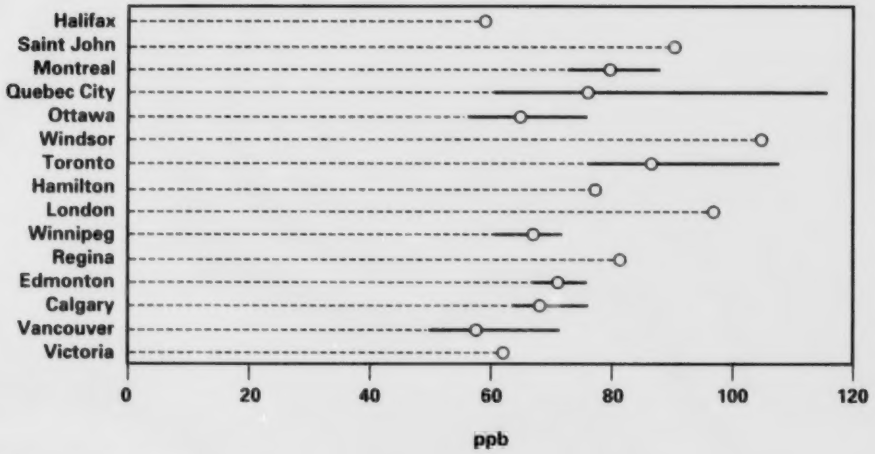
### Figure 5
### Annual Average Levels of $NO_2$ in Selected Canadian Cities



Source: Environment Canada, 1990.

*Figure 6*

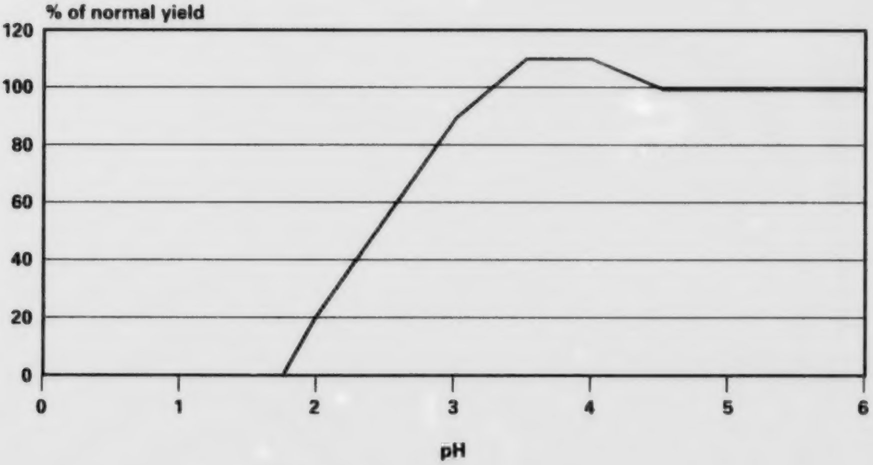
AVERAGE OF PEAK HOURLY OZONE LEVELS IN SELECTED CANADIAN CITIES, 1983–1987



**Source: Environment Canada, 1990.**

*Figure 7*

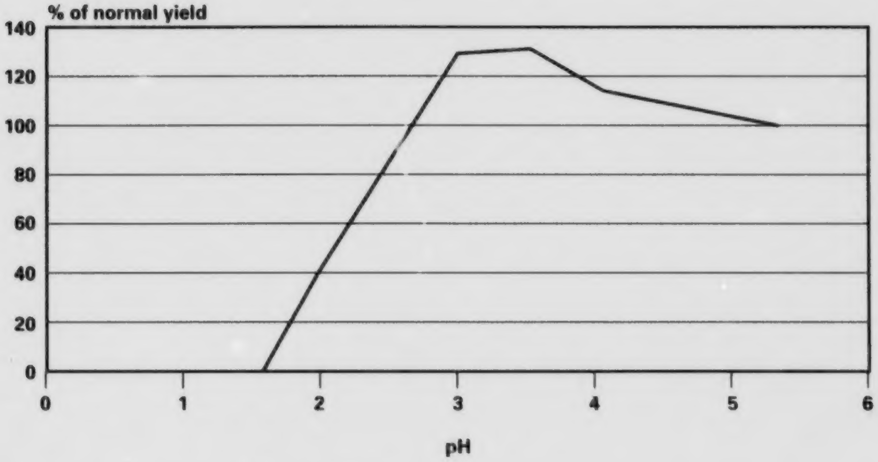
DOSE-YIELD RESPONSE OF COLE CROPS TO pH OF RAINFALL



**Sources: Victor and Burrell, 1982; DPA, 1987.**

Figure 8

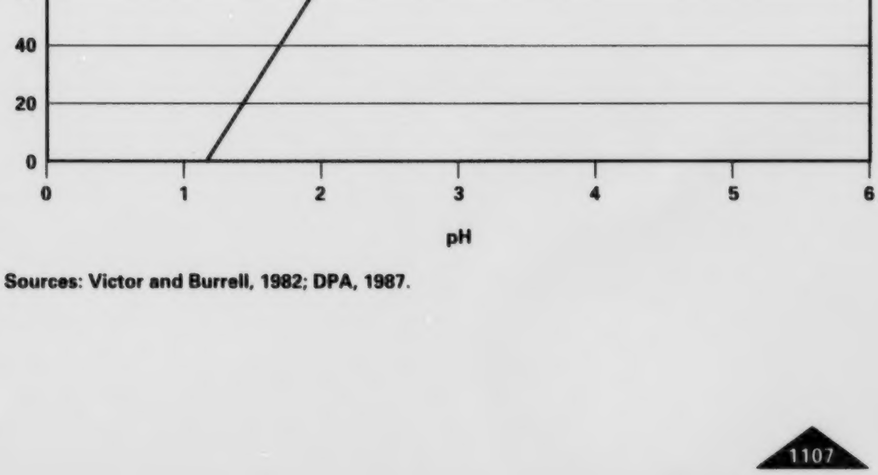
DOSE-YIELD RESPONSE OF FRUIT CROPS TO pH OF RAINFALL



Sources: Victor and Burrell, 1982; DPA, 1987.

Figure 9

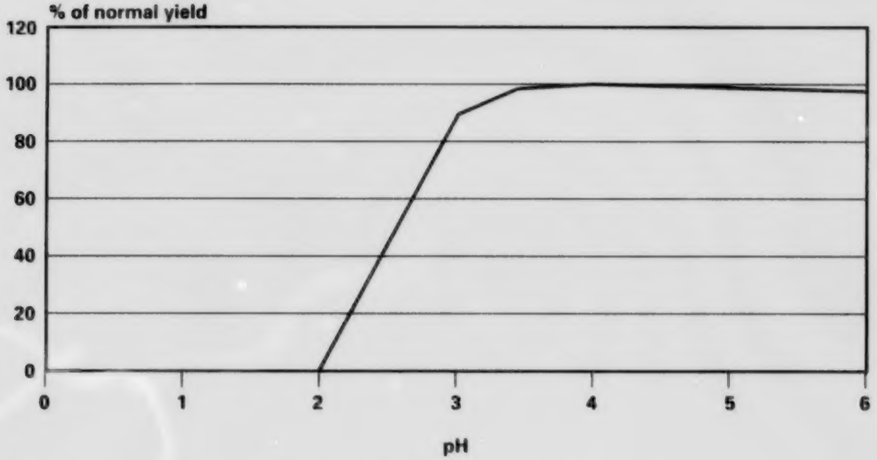
DOSE-YIELD RESPONSE OF GRAINS AND FORAGE TO pH OF RAINFALL



Sources: Victor and Burrell, 1982; DPA, 1987.

*Figure 10*

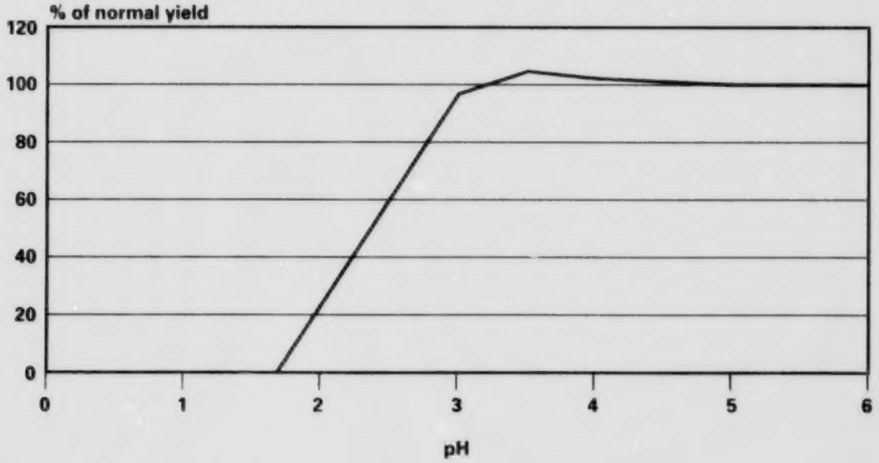
**DOSE-YIELD RESPONSE OF LEAF CROPS TO PH OF RAINFALL**



**Sources: Victor and Burrell, 1982; DPA, 1987.**

*Figure 11*

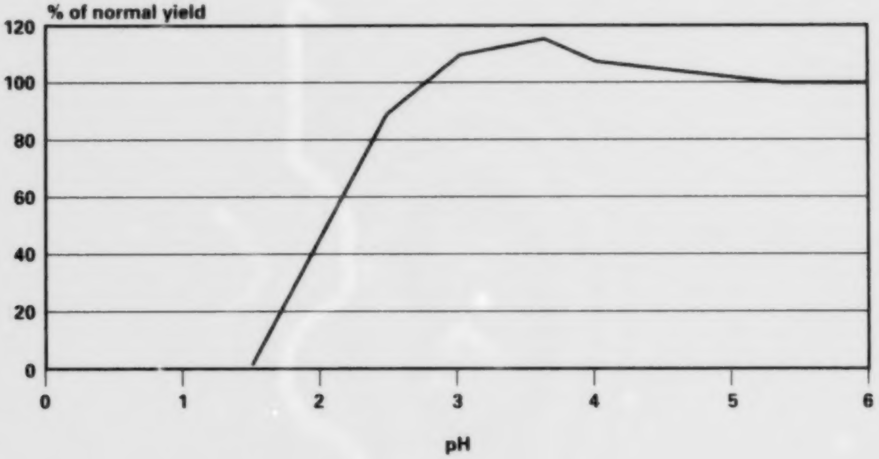
**DOSE-YIELD RESPONSE OF LEGUMES TO PH OF RAINFALL**



**Sources: Victor and Burrell, 1982; DPA, 1987.**

Figure 12

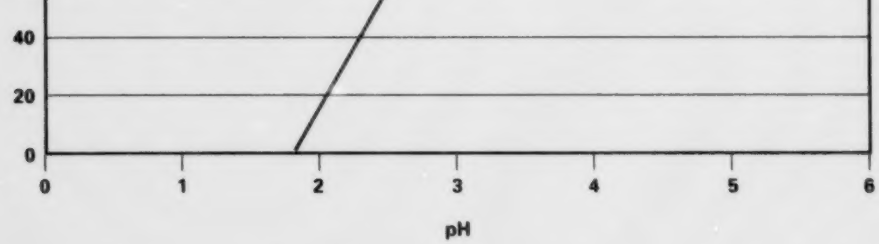
DOSE-YIELD RESPONSE OF ONIONS TO PH OF RAINFALL



**Sources: Victor and Burrell, 1982; DPA, 1987.**

Figure 13

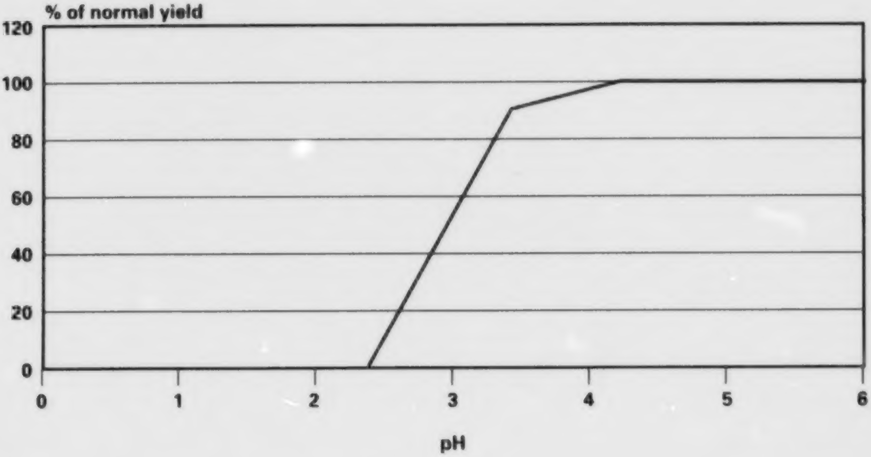
DOSE-YIELD RESPONSE OF POTATOES TO PH OF RAINFALL



**Sources: Victor and Burrell, 1982; DPA, 1987.**

*Figure 14*

***Dose-Yield Response of Root Crops to pH of Rainfall***



**Sources: Victor and Burrell, 1982; DPA, 1987.**

*Table 12*

***Summary of the Availability of Data Relating Exposure Levels to Crop Damage***

| Species | Pathway | Pollutant | Dose-yield available | Dose-surrogate response available | Notes |
|---|---|---|---|---|---|
| cereal crops | fumigation | nitrogen oxides | no | no | deposition causes acidification of soil; however, land management practices generally negate the impact of acidification on soil |
| | | photochemical oxidants | yes | no | variation in response due to exposure length |
| | | dry acid deposition | no | no | |
| | deposition | nitrogen oxides | no | no | in low concentrations $NO_x$ may cause increased rather than decreased yield due to the fertilizer effect |
| | | acid deposition | yes | no | |

*Table 12 (cont'd)*

**SUMMARY OF THE AVAILABILITY OF DATA RELATING EXPOSURE LEVELS TO CROP DAMAGE**

| Species | Pathway | Pollutant | Dose-yield available | Dose-surrogate response available | Notes |
|---|---|---|---|---|---|
| row crops | fumigation | nitrogen oxides | no | no | deposition causes acidification of soil; however, land management practices generally negate the impact of acidification on soil |
| | | photochemical oxidants | yes | no | variation in response due to exposure length |
| | | dry acid deposition | no | no | |
| | deposition | nitrogen oxides | no | no | in low concentrations $NO_x$ may cause increased rather than decreased yield due to the fertilizer effect |
| | | acid deposition | yes | no | |

**Source: Concord Environmental and VHB, 1991**

*Aquatic biota:* Of the pollutants being examined, only nitrogen oxides deposited in the form of acid precipitation appear to have direct adverse effects on aquatic ecosystems. Sulphur dioxide from transportation is a minor contributor to acid deposition (OECD, 1988).

Aquatic ecosystems are affected either through direct acidic deposition on the surface waters or through acidification of soils in the watershed which reduces the neutralizing capability of the run-off water. The main effects of increased acid deposition on surface water chemistry include:

- decrease in lake pH;
- decline in lake alkalinity;
- increase in concentrations of trace metals (Hg, Pb, Cd, Zn, Ni, Mn); and
- increase in concentrations of organic and inorganic aluminium.

These changes in surface water chemistry have been shown to cause changes to the production and richness of aquatic communities. Rapid depressions in pH usually occur during spring snowmelt. Acid pulses can hinder reproduction, especially in river spawning species since the largest increases in surface water acidity occur at shallow depths. The degree to which fish species are affected by acid pulses depends on the species and the life stage of the fish.

The biological recovery of lakes after deposition is uncertain. Studies in the Sudbury area suggest that biological recovery does not occur, probably because of the high residual concentrations of trace metals and acidic compounds. The liming of lakes may result in some biological recovery. Whether the recovery will result in the same biological community that existed before remains uncertain (Concord Environmental and VHB, 1991).

The impacts of $NO_x$ emissions on fish populations cannot be described in terms of simple dose-response curves but instead requires extensive modelling to show the contribution of $NO_x$ emissions to surface water acidity and the effects of changes in surface water chemistry to aquatic biota. Response models typically use pH and aluminium toxicity thresholds for individual species as the primary input mechanism.

Table 13 summarizes the availability of data relating acidification to aquatic resources.

*Table 13*

Summary of the Availability of Data Relating Acid Deposition to Changes in Aquatic Resources

| Species | Pollutant and pathway | Dose-yield available | Dose-surrogate available | Link between surrogate and yield known |
|---|---|---|---|---|
| fish species | acid deposition | Yield models relying on toxicity thresholds of individual species available. | no | no |
| invertebrates | acid deposition | Existing fish-yield models can be adapted to estimate response of invertebrates. | no | no |
| aquatic vegetation | acid deposition | no | no | no |

*Materials:* The pollutants of primary concern for materials damage are:

- nitrogen oxides ($NO_x$) — primarily nitrogen dioxide ($NO_2$);
- ozone — arising from the reaction of $NO_x$ with sunlight; and
- particulates.

The transportation sector contributes only minor amounts to the total $SO_2$ concentrations in the atmosphere, however $SO_2$ and $NO_x$ combined contribute significantly to acid deposition (VHB, 1991a). Acid deposition has long been implicated as a major factor in material degradation. Carbon dioxide is also emitted from motor vehicles and has been linked to the corrosion of metals. The contribution of $CO_2$ to current ambient concentrations of $CO_2$ in the atmosphere is minor.

The primary impact pathways for materials damage are:

- corrosion or abrasion due to fumigation and deposition; and
- soiling of surfaces due to fumigation and deposition.

The pollutants corresponding with each of the pathways listed above are as follows:

- $NO_x$, $O_3$, $HNO_3$, $H_2SO_4$; and
- particulate emissions.

There are few data on the actual effects of these pollutants on materials and most damage is expected to occur in urban areas. Much of the research has concentrated on the effects of sulphur dioxide and acid deposition on materials (Acres, 1991). There are few quantitative data on the effects of other pollutants on materials. Where data are available, they are usually based on lab conditions and are at levels which are orders of magnitude above those existing in the Canadian urban environment. No minimum effect level has been established, and there is no evidence that existing levels in the Canadian environment adversely affect materials.

Table 14 lists the pollutants thought to have some damaging effect on materials.

*Table 14*

## MATERIALS DAMAGE AND THE POLLUTANTS INVOLVED

| Material | Effect | Cause | Comments/references |
|---|---|---|---|
| metal materials such as carbon steel, zinc, aluminum and copper | For nickel and zinc there is no significant effect at exposure levels of 1 ppm ozone or 0.5 ppb nitrogen dioxide. The mean annual concentrations of $NO_2$ and ozone in most urban environments in Canada are significantly lower than this. | $NO_2$, $HNO_3$, ozone | Ahuja and Amar (1988) found that exposure of 10 ppm nitrogen dioxide had mild effects on galvanized steel. |
| paint | Particulates cause the soiling of paints. There is no evidence that $NO_2$, $HNO_3$ and ozone affect the rate of paint deterioration at levels found in the Canadian urban environment. | Particulate, $NO_2$, $HNO_3$, ozone | Continually changing paint formulations make damage difficult to assess. In addition, it is difficult to distinguish the effects of pollutant deposition and natural weathering processes from ultra-violet radiation, moisture and temperature fluxes. |
| building stones | Carbonate stone is very susceptible to acidic deposition which causes the formation of a crust on the stone. Limestone exposed to acid rain deteriorates about 10 times faster than when exposed to $SO_2$ or $NO_2$ at 90% relative humidity individually (Lindquist et al., 1988). Particulate may catalyze the oxidation of $SO_2$ and $NO_x$ making them more effective reactants. The contribution of acidic deposition to physical weathering is unknown (NAPAP, 1987). | $SO_2$, Particulate, $NO_2$, $HNO_3$, ozone | Nitrogen dioxide, sulphur dioxide and ozone can increase the rate of calcareous deterioration. There is no evidence, however, that the levels of nitrogen dioxide and ozone found in the Canadian urban environment can significantly affect the deterioration rate of building stone. Haneef (1990) reported a synergistic effect from sulphur dioxide, ozone and nitrogen dioxide compared with exposure to each pollutant alone. |
| concrete, brick and mortar | Lime mortars are sensitive to acidity due to the acid soluble nature of calcium and magnesium carbonates. | Particulate, $NO_x$ | Concrete is not considered sensitive to acidic deposition due to its thickness. |

*Table 14 (cont'd)*
*MATERIALS DAMAGE AND THE POLLUTANTS INVOLVED*

| Material | Effect | Cause | Comments/references |
|---|---|---|---|
| glass | Soiling due to soil and road dust. Damage to medieval stained or painted glass. | Particulate | Glass is generally quite resistant to the effects of acidic deposition. |
| wood | Degradation. | $NO_x$, ozone | For wood treated with a preservative it is the coating that is important in determining the effects. |
| asphalt | Little is known about the effects of air pollutants on asphalt materials. | ozone | |
| rubber | | ozone | The contribution of ozone to rubber degradation has been significantly reduced by the inclusion of anti-ozonants in the manufacture of tires. |
| fabrics | Fading of dyes. Particulates may cause the soiling of fabrics. | $NO_x$, ozone | Much of the research has concentrated on higher levels of nitrogen dioxide and ozone than found in the ambient air. |

**Source: Concord Environmental and VHB Research and Consulting Inc., 1991.**

### 4.2.6 Assessment of Individuals or Populations at Risk

"Risk is the potential for realization of unwanted, negative consequences of an event" (Rowe, 1977, p. 24). Risk is expressed as the probability of mortality or morbidity for an individual or entire population occurring as a result of a certain level of exposure. Assessing the populations at risk requires knowledge of the following:

- the duration and level of exposure to pollutants at varying distances from the source;[12] and
- dose-response functions for each of the potential receptors to each of the pollutants.

Though some dose-response functions are available (human response to direct deposition of pollutants; response of forest species and crops to varying ozone concentrations; and response of some aquatic species to various levels of lake/stream acidity), ambient conditions attributable to individual modes of transportation are not known and, as a result, risk cannot be calculated.

## 4.3 ECOLOGICAL ANALYSIS

As indicated in Section 2, ecological analysis refers to population, community or ecosystem effects of emissions or loss of habitat from changes in land use. Table 15 summarizes the expected damage to air, water and land resources by mode of transportation.

*Table 15*

SUMMARY OF POSSIBLE ENVIRONMENTAL EFFECT BY MODE OF TRANSPORTATION

| | **Air** | **Water resources** | **Land resources** | **Other impacts** |
|---|---|---|---|---|
| Marine/ ferries | Air pollution (CO, HC $NO_x$, particulate); global pollution (CFCs released during vehicle manufacture and disposal, $CO_2$ from fossil fuel combustion) | Discharge of ballast water, oil, spills, etc. Modification of water systems during port construction and canal cutting and dredging | Land taken for infrastructure; dereliction of obsolete port facilities and canals; vessels and craft withdrawn from service | |
| Railroad | Air pollution (CO, HC, $NO_x$, particulate and fuel additives such as lead). Global pollution ($CO_2$, CFCs) | | Land taken for rights-of-way and terminals; dereliction of obsolete facilities; abandoned lines, equipment and stock | Partition or destruction of neighbourhoods, farmland and wildlife habitats |
| Road/ highway | Air pollution (CO, HC, $NO_x$, particulate and fuel additives such as lead). Global pollution ($CO_2$, CFCs) | Pollution of surface water and ground water by surface run-off (lubricants, coolants, road salt); modification of water systems by road building | Land taken for infrastructure; extraction of road building materials; abandoned spoil tips and rubble from road works; road vehicles withdrawn from service; waste oil | Partition or destruction of neighbourhoods, farmland and wildlife habitats; congestion |

*Table 15* (cont'd)

SUMMARY OF POSSIBLE ENVIRONMENTAL EFFECT BY MODE OF TRANSPORTATION

| | Air | Water resources | Land resources | Other impacts |
|---|---|---|---|---|
| Aircraft | (CO, HC, $NO_x$, particulate); global pollutants (CFCs, $CO_2$) | Modification of water tables, river courses and field drainage in airport construction | Land taken for infrastructure; dereliction of obsolete facilities; aircraft withdrawn from service | |

**Source: Adapted from OECD, 1991.**

Table 16 shows the land required by mode of transportation. Highways require almost twice as much land per linear kilometre as railroad tracks.

*Table 16*

LAND USE IN THE TRANSPORTATION SECTOR, 1985

| Transportation mode | Width (m) | Land use per km ($m^2$) |
|---|---|---|
| **Highway** | | |
| Buffer | 22.0 | 22,000 |
| Shoulder | 9.5 | 9,500 |
| Road | 14.0 | 14,000 |
| **Total** | **45.5** | **45,500** |
| Air | na | na |
| **Railroad** | | |
| Buffer | 11.0 | 11,000 |
| Track | 13.9 | 13,900 |
| **Total** | **24.9** | **24,900** |
| Marine | na | na |

**Source: Statistics Canada, *Human Activity and the Environment*, 1991.**

# 5. OVERVIEW OF ESTIMATES OF ENVIRONMENTAL DAMAGE SOCIAL COSTS

## 5.1 VALUE OF ENVIRONMENTAL DAMAGE

Table 17 presents the estimated costs of environmental damage by pollutant and type of damage. The damage resulting from the pollutants is the basis for the "starting point" costs caused by each pollutant, except for the costs

*Table 17*

**STARTING POINT COSTS OF ENVIRONMENTAL DAMAGE BY POLLUTANT (1989$/KG)**[a]

| Damage | Effect | $SO_2$ | $NO_x$ and ozone | Acid deposition | Particulate | Carbon dioxide |
|---|---|---|---|---|---|---|
| Health | Mortality | 4.48 | 0.89 | na[b] | 0.86 | na |
| | Morbidity | 0.13 | 0.76 | na | 0.08 | na |
| | Total | 4.61 | 1.64 | 0.00[c] | 0.94 | na |
| Materials | Corrosion/ Soiling | 0.31 | 0.03 | na | 0.00 | na |
| Vegetation | Crops | 0.00 | 0.03 | na | 0.00 | na |
| | Ornamental forests | | | | 0.00 | |
| Visibility | | 0.36 | 0.44 | na | 2.16 | na |
| Ecosystems | | na | na | na | 0.00 | na |
| Historical monuments | | na | na | na | 0.00 | na |
| **Total** | | **5.29** | **2.14** | **0.00** | **3.10** | **0.018**[d] |

**Source: Ottinger et al., 1990.**

[a] The damage resulting from the pollutants is the basis for the determination of the external costs caused by each pollutant, except for the external costs of $CO_2$ emissions which reflect the cost of damage control (Ottinger et al., 1990, p. 58). The *starting point* costs are based on a survey of a number of studies estimating the external costs of electricity generation. "The uncertainties associated with these [cost] estimates in their original studies are large; the studies did not have estimates for some potentially important effects; and the existence and magnitude of some of the reported effects are still in dispute. These estimates should be used with great caution, as they indicate only the magnitude of damages." (Ottinger et al., 1990, p. 228)

[b] na — not available. Value of environmental damages not estimated, though they may exist.

[c] Value of environmental damage estimated and found equal to zero.

[d] The control cost of sequestering the $CO_2$ emitted into the atmosphere by planting trees or other vegetation (Ottinger et al., 1990, p. 138).

of $CO_2$ emissions which reflect the cost of damage control (Ottinger et al., 1990). The "starting point" costs are based on a number of surveys of external costs from electricity generating stations and estimates of the external costs of typical coal generating stations. Caution is advised in their use. The estimates are generic in nature for stationary sources in or near urban areas. Intercity transportation environmental damage will often arise in more isolated regions of the country.

The estimates of the values of environmental damage found in Ottinger et al. (1990) were the result of a two-year study reviewing evaluation methods and environmental cost estimates for power generation utilities in the United States. The analytical framework used can be described as follows:

- identify pollution sources and the quantity of emissions;
- estimate the dispersion of these emissions;
- identify the groups (humans, ecosystems, materials, etc.) exposed to the pollutants;
- estimate the responses between the groups exposed and the pollutants; and
- estimate the value of these responses (replacement costs, contingent valuation, hedonic prices, travel costs, market prices).

This study utilizes the estimates of the value of the dose-response relationships reviewed in Ottinger et al. (1990) as the best estimate of the potential value of environmental damage from different modes of intercity passenger transportation.

Alternative costs of environmental damage from power generation exist. Ontario Hydro developed estimates of damage from $NO_x$ and $SO_2$ and particulate emissions arising from the export of electricity (Concord Environmental and VHB, 1991; Acres, 1991; Phytotoxicology Consultant Services, 1990; VHB, 1991a). The estimates for $SO_2$ environmental damage are presented in Table 18. The estimates of damage from other air emissions in the Ontario Hydro studies are not available for comparison with Ottinger et al. (1990). The estimates of environmental damage from $SO_2$ in the Ontario Hydro study are lower than those suggested in Ottinger et al. (1990).

The estimates of damage developed by Ontario Hydro were not used in this study since they have not yet been subject to peer review.

### *Table 18*

### *Comparison of Ontario Hydro and Ottinger et al. (1990) Environmental Damage from Sulphur Dioxide Emissions*

| Location | Mortality[a] | | Morbidity[a] | | Materials damage[b] (1989$/kg) |
|---|---|---|---|---|---|
| | Fatalities/kt | (1989$/kg) | Illnesses/kt | (1989$/kg) | |
| Lambton | 0.03 | 0.12 | 15 | 0.01 | 0.04 |
| Nanticoke | 0.07 | 0.28 | 17.5 | 0.01 | 0.05 |
| Lakeview | 0.5 | 2.00 | 162.7 | 0.08 | 0.09 |
| Ottinger, 1991 | 0.95 | 4.48 | 54 | 0.13 | 0.31 |

[a] **Concord Environmental and VHB Research and Consulting Inc., 1991.**

[b] **Acres, 1991.**

**Note:** **Assumes $4 million per fatality and $485 per illness for the Canadian generating stations.**

The major source of environmental damage is from $SO_2$, particularly health and materials damage. These costs (1989$) total an estimated $5.29/kg of pollutant emitted. The estimated cost of impaired visibility due to $SO_2$ is $0.36/kg. The transportation sector is not considered to be a major source of $SO_2$ emissions. Only about 2 percent of all emissions originate from the transportation sector.

Particulates are the major contributor to impaired visibility, resulting in an estimated cost of $2.16/kg of pollutant. The estimated health cost of particulate is $0.94/kg. $NO_x$ and ozone result in estimated health costs of $1.64/kg, materials damage of $0.44/kg, crop (vegetation) damage of $0.03/kg and visibility damage of $0.03/kg.

An estimate of the control cost of global warming ($CO_2$) is also presented in Table 17. The control cost presented is for establishing and maintaining a forested area that is capable of absorbing $CO_2$ through photosynthesis (that is, carbon sequestration). This forest must be maintained in perpetuity to continue to store the carbon released once through fossil fuel combustion. The cost is about $0.02/kg of $CO_2$.

The direct costs of environmental damage is greatest from $SO_2$, estimated at $5.29/kg. The cost of environmental damage arising from particulate emissions is estimated at $3.10/kg and the costs of $NO_x$ and ozone emissions are about $2.14/kg.

### 5.2 APPLICATION AND LIMITATIONS OF ESTIMATES

The estimated values presented in this study are for the power generation sector or other stationary sources. The power generation sector is a significant contributor, through the burning of fossil fuels, to atmospheric emissions of the same pollutants emitted by passenger transport vehicles. The costs presented in Table 17 are those that seem to most reasonably represent the range of values in the studies reviewed (Ottinger et al., 1990), considering the location at which the studies were performed, their documentation and their thoroughness. Too many relevant costs are overlooked by the studies and the studies included vary in quality and level of documentation. As a result the figures presented are not actual cost estimates but serve as a "starting point" to provide an order-of-magnitude of the studies reviewed and a starting point for further research (Ottinger et al., 1990).

The direct cost estimates of environmental damage presented in Table 17 leave out many potential effects and are likely to be conservative. More complete estimates should include the environmental damage arising from air emissions not included in the present estimates, such as the greenhouse gases, methane, $N_2O$ and toxics, heavy metals, ozone precursors and hydrocarbons, and other environmental damage such as water and land use and solid waste disposal (Ottinger et al., 1990).

Cost estimates of the environmental damage of the construction and maintenance of infrastructure, the manufacture and disposal of vehicles and the manufacture and distribution of fuel do not exist and must be developed.

## 6. COSTS OF ENVIRONMENTAL DAMAGE BETWEEN DIFFERENT MODES OF PASSENGER TRANSPORTATION

Costs of each transport mode by contaminant and damage are presented in Table 19. These cost estimates are based on the direct costs of environmental damage and the emissions of pollutant per passenger-kilometre (pass-km) developed previously. The range of environmental damage presented reflects the range of emissions of each pollutant by mode of transport presented previously. The environmental damage shown in Table 19 varies by mode of transport and type of damage.

*Table 19*

### TOTAL ENVIRONMENTAL DAMAGE

### 1989$/1,000 PASS-KM

| | Health mortality | | Morbidity | | Total health | | Materials corrosion | | Crops | | Visibility | | Global warming | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Transport mode** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| Intercity bus transport | 0.73 | 1.28 | 0.39 | 0.67 | 1.12 | 1.95 | 0.03 | 0.06 | 0.01 | 0.02 | 0.30 | 0.52 | 0.66 | 1.20 | 2.12 | 3.75 |
| Motor vehicles | 1.66 | 1.81 | 0.53 | 0.65 | 2.19 | 2.46 | 0.06 | 0.06 | 0.02 | 0.02 | 1.57 | 1.66 | 2.08 | 2.10 | 5.92 | 6.31 |
| Air transport | 0.11 | 0.79 | 0.07 | 0.61 | 0.18 | 1.40 | 0.00 | 0.03 | 0.00 | 0.02 | 0.05 | 0.38 | 2.55 | 5.85 | 2.79 | 7.68 |
| Railroad transport (VIA only) | 3.13 | 6.09 | 1.90 | 3.64 | 5.03 | 9.73 | 0.13 | 0.24 | 0.06 | 0.12 | 1.32 | 2.80 | 2.20 | 4.18 | 8.74 | 17.07 |
| Marine transport | 0.38 | 0.87 | 0.02 | 0.05 | 0.40 | 0.92 | 0.03 | 0.06 | 0.00 | 0.00 | 0.04 | 0.10 | 0.16 | 0.37 | 0.63 | 1.44 |

**Note:** **Values are rounded.**

The health costs per 1,000 passenger-kilometres for rail passenger transportation are estimated at between $5 and $10 (1989$)/1,000 pass-km. Private passenger motor vehicle transportation health costs are estimated at between $2.2 and $2.5/1,000 pass-km. The health costs for intercity bus transportation are valued between $1.1 and $1.9/1,000 pass-km. Marine transportation health damage is valued between $0.4 and $0.9/1,000 pass-km. Air passenger transport health costs are valued at an estimated $0.3 to $1.4/1,000 pass-km.

Rail passenger transportation causes the highest estimated materials damage, $0.1 to $0.2/1,000 pass-km. Private motor vehicles cause an estimated $0.05 to $0.06/1,000 pass-km of materials damage. Materials damage from marine passenger and intercity bus transport are estimated at between $0.03 and $0.06/1,000 pass-km. The cost of materials damage arising from air transport are negligible, less than $0.03/1,000 pass-km.

Rail passenger transport results in an estimated $0.06 to $0.12/1,000 pass-km in crop damage. Private motor vehicles cause about $0.02/1,000 pass-km in crop damage. Crop damage from intercity passenger bus transport is estimated to cost between $0.01 and $0.02/1,000 pass-km. Crop damage from air and marine passenger transport is negligible, less than $0.02/1,000 pass-km from air transport and less than $0.001/1,000 pass-km from marine transport.

Rail passenger transport results in an estimated $1.3 to $2.8/1,000 pass-km and private motor vehicles between $1.6 and $1.7/1,000 pass-km of visibility damage. Visibility damage from intercity passenger bus transport is estimated at between $0.3 and $0.5/1,000 pass-km. Air passenger visibility damage is estimated to cost between $0.05 and $0.4/1,000 pass-km. Visibility damage arising from marine passenger transportation is less than $0.1/1,000 pass-km.

The control cost of global warming resulting from $CO_2$ emissions is greatest from air transport, between $2.6 and $5.9/1,000 pass-km. Rail passenger transport results in a control cost estimated at $2.2 to $4.2/1,000 pass-km. Global warming control costs from private motor vehicles are estimated at about $2.1/1,000 pass-km. Global warming control costs from intercity passenger bus transport are estimated at between $0.7 and $1.2/1,000 pass-km. Marine global warming control costs are estimated at between $0.2 and $0.4/1,000 pass-km.

Table 20 presents a comparison of the environmental costs of transportation modes. At present only preliminary cost estimates of the operation and maintenance of transportation systems are available. On a passenger-kilometre basis, railroad transportation results in the highest environmental damage, up to $17/1,000 pass-km, and marine passenger service the least damage at between $0.6 and $1.4/1,000 pass-km. Private passenger motor vehicles result in the second highest damage-between $5.9 and $6.3/1,000 pass-km, followed by air and intercity bus transport at $2.8 to $7.7 and $2.1 to $3.8/1,000 pass-km respectively.

*Table 20*
DAMAGE BY MODE OF TRANSPORTATION AND ORIGIN

| Transportation mode | Construction and maintenance of infrastructure | Vehicle manufacture and disposal | Fuel manufacture and distribution | Vehicle operation and maintenance (1989$/ 1,000 pass-km) |
|---|---|---|---|---|
| Intercity bus | na | na | na | 2.1–3.8 |
| Motor vehicle | na | na | na | 5.9–6.3 |
| Air | na | na | na | 2.8–7.7 |
| Railroad | na | na | na | 8.7–17.1 |
| Marine | na | na | na | 0.6–1.4 |

**Note:** **na — not available.**

## 6.1 APPLICATION AND LIMITATIONS OF ESTIMATES

The estimated values of environmental damage presented in Table 19 are based on estimates of the value of environmental damage in the power generation sector. The valuing of environmental damage undertaken for electricity generating stations is not completely applicable to the transportation sector. Of particular concern is the costs arising from $SO_2$. Power generating utilities have placed a large emphasis on the costs arising from $SO_2$ emissions due to regulatory and public concerns about acid rain. The transportation sector is not a major contributor to $SO_2$. As a result the values attributed to $SO_2$ emissions from power generation may not be totally appropriate for the transportation sector.

Also, the health damage used in the electricity generation sector studies relate to power stations in or near urban areas. Although intercity travel involves transportation in and through urban areas, the actual exposure of humans to emissions from passenger transportation would be less than those stated in Ottinger et al. (1990).

The estimates of the value of environmental damage may leave out many potential effects and, as a result, damage may be undervalued. More complete estimates should include the environmental damage arising from air emissions not included in the present estimates, such as the greenhouse gases, methane and $N_2O$, toxics, heavy metals, ozone precursors and HC, and other environmental damage such as water, land use and solid waste disposal (Ottinger et al., 1990).

Finally, estimates of environmental damage on a passenger-kilometre basis can fluctuate widely depending on the occupancy of the passenger vehicle. As the occupancy of the transport mode increases, the emissions and environmental damage on a passenger-kilometre basis will decrease.

## 7. MAJOR OBSTACLES TO ESTIMATING SOCIAL COSTS OF ENVIRONMENTAL DAMAGE

It is apparent from the previous sections that both the theoretical and empirical bases of evaluating the social costs of environmental damage from transportation continue to have major gaps and deficiencies. Nevertheless, substantial progress has been made, especially during the last decade, in developing a more robust theoretical framework for evaluation. There has also been a growing body of increasingly sophisticated empirical studies with principal contributions coming originally from the United States and now more from Europe. Unfortunately, empirical studies directed to producing definitive results are still demanding and costly undertakings. Furthermore the quantitative results of these studies cannot usually be generalized, and may only be suggestive in other contexts.

There are several theoretical and practical issues which recur in efforts to evaluate the social costs of environmental damage. Some of these issues are discussed briefly in the following subsections, to provide an assessment (in the next section) of the potential for research to produce more precise and reliable estimates.

## 7.1 THEORETICAL ISSUES

In conducting studies to estimate the social costs of environmental damage, or in interpreting these studies, it is important to keep in mind several fundamental theoretical issues. These issues are inherent in the evaluative framework and in any attempts to apply it. The issues that are discussed here include only those that are general and are not specific to particular methods of evaluation.

### 7.1.1 Scoping

In assessing environmental damage, especially from a "non-point source" such as transportation, it is often difficult to define the geographic and temporal extent (that is, the scope) of the effects. For example, in an environmental impact assessment for a transportation infrastructure project, such as an airport or highway, scoping may involve distinguishing the distances over which impacts will be assessed. Similarly, there will be explicit or implicit distinctions of the time horizons over which impacts and effects occur.

Scoping is based on assessment of the nature and magnitudes of possible impacts, and on consideration of the scientific (ecological) *and* socio-economic significance of these impacts. Thus, socio-economic significance is recognized as one of the constitutive requirements for an environmental impact or effect.

This accords with the perspective of economic theory, whereby a social cost is incurred only if there is *both* a physical effect *and* a loss in someone's welfare as a consequence of this effect. As previously suggested, restriction of concern to the social costs of environmental damage can be criticized as being anthropocentric. This criticism can be met, at least partially, by taking a broad view of the environmental services that contribute to human well-being (for example, including the existence values that humans attribute to other species).

The economic perspective of equating effects with social costs has at least one compelling advantage in that it provides criteria for assessing the importance of effects, and thus for devoting attention to them accordingly. It also accords salience to environmental effects in economic and policy arenas.

Although the economic perspective helps to focus the problems of spatial and temporal scoping, it does not eliminate them. It remains difficult to determine, for example, how far to go in following cause-effect linkages in assessing the effects of emissions. The cause-effect linkages quickly ramify and become more diffuse. Although more diffuse, the effects can be more widespread and subtle, and thus still have greater consequences overall. Clearly, there are practical limits to how far it is possible to explore cause-effect linkages, but we should not confuse these limits with the limits of the effects themselves.

In the case of intercity passenger transportation, the spatial extent of known effects ranges from local impacts, such as particulate emissions, to global implications from carbon dioxide emissions contributing to global warming. In the temporal dimension, the effects may range from immediate irritation and discomfort to long-term implications for health, and possible modifications of ecosystem function and structure. These latter effects may extend not only over current generations, but also over future generations.

Economic theory provides very uncertain guidance for addressing the problem of temporal scoping. The usual approach in economic evaluation has been to discount future costs and benefits, that is, to reduce the present value equivalence of future costs and benefits according to their distance in the future. This usually has the effect of making costs and benefits, more than about 10 years in the future, almost insignificant. Concerns about the environmental sustainability of economic development have raised questions about this practice.

There is limited scope for addressing these concerns within current economic theory, but three avenues hold some promise:

- Arguments can be made that the value of natural amenities will increase, relative to marketed goods and services, as the relative (or absolute) abundance of these natural amenities decreases and as the demand for them grows with increasing discretionary time and income. This tends to offset the effects of discounting in diminishing the costs of losing environmental amenities (Krutilla and Fisher, 1985).

- It may be possible to find ways of incorporating intergenerational equity as a more explicit consideration in economic evaluation, beyond the notion of bequest value, introduced previously, which considers the value of making bequests only to those who make them.
- Several further arguments can be invoked (Pearce and Turner, 1990) to support a general principle that economic activities should be guided to ensure that "natural capital" is maintained or enhanced.

The need for new approaches, such as those mentioned above, is made more compelling when the following issues are considered.

If human values are considered to apply, (in a sufficiently broad fashion) over ecosystem components and functions, and over time, then the problem of scoping is constrained more by available knowledge of biophysical causes and effects than by economic criteria.

### 7.1.2 Valuation

Although it is possible in theory to take a broad view of human values relating to the environment, in practice the methods for determining these values are far from simple or comprehensive. This means that it is usually necessary to be selective about which environmental values are evaluated in a particular case. There is justifiable concern that in such a process, the "soft" and diffuse environmental values will be undervalued compared with the usual "hard" economic values.

Whether or not there is such a selection, it is always necessary to discriminate among the values that are being assessed, so there can be clarity about what one is evaluating. In practice, it is often very difficult to disentangle values or motives, and to compare value measures produced by different methods.

This difficulty may be present not only for the economist attempting to assess values, but also for the people themselves who are doing the evaluating. This applies particularly to existence values, but existence values may themselves be confounded with other values.

Sagoff (1988) has questioned whether the "self-regarding values" of standard economic evaluation are commensurable with the "group-regarding" values attributed to the natural and cultural heritage, such as unique or special natural areas or historic monuments. The attempt to make such environmental values in dollars may implicitly contribute to the "down-valuation" of the former (Kelman, 1981).

Furthermore, as previously noted, evaluation presupposes knowledge of those things that contribute to our well-being. Costanza (1991), as quoted previously, questions to what extent this knowledge can be presupposed on the part of the general public with regard to ecosystem functions, when scientists are only just beginning to discover the contributions of these functions to our life support and well-being.

When such values are at stake in public policy, evaluations by individual members of the public must be circumscribed by a broader process of public deliberation which includes contributions from scientists. These deliberations must also recognize the limited knowledge that scientists have about ecosystem processes and functions, and the unknown risks of actions and practices that interfere with these functions. With improvements in knowledge, it is presumed that people's most basic evaluations would converge with the imperative to protect the ecosystem functions on which life depends.

### 7.1.3 Equity

The economic measures of value discussed here are based fundamentally on people's willingness to pay (WTP) or willingness to accept (WTA). These measures raise considerations about equity within generations (intragenerational equity) and equity across generations (intergenerational equity).

With regard to intragenerational equity, it is clear that people's willingness to pay depends on their ability to pay, and that ability to pay differs greatly among individuals in society. Similarly, compensation demanded is evaluated relative to one's overall assets, and accordingly is greater for those with greater assets.

These disparities mean that individual evaluations carry different weights in the overall social evaluation according to each individual's ability to pay. Disparities may also be manifest in the different incidence of environmental harm for [illegible]uals in society, with those in less affluent areas subject to greater harm (such as higher levels of pollution).

Although there are many types of environmental harm which individuals in society have a common interest to prevent, regardless of their level of affluence, the disparity in weightings of individual evaluations according to affluence may be reflected in relative evaluations of environmental problems. These problems tend to be in the form of amenity losses for the more affluent, and in the form of health implications for the less affluent.

These potential biases should be borne in mind at the scoping stage. Reference has been made earlier (Section 3) to possible methods of compensating or correcting for these disparities in evaluation.

Future generations, by definition, are not present to express their views, or have their WTP or WTA count in current evaluations. This leads to the problem of intergenerational equity. Again, impacts for future generations should be given special attention at the scoping stage, and methods should be developed to account for these impacts in overall evaluation.

### 7.1.4 Uncertainty

Scientific uncertainty about environmental impacts is pervasive in evaluation. Uncertainty (in the sense of only probabilistic knowledge of the parameters' bearing on cause-effect relationships) can be addressed through expected utility theory if risk profiles and attitudes can be determined. A more considerable kind of "uncertainty" is a complete lack of knowledge of potentially important causal relationships.

Much of the uncertainty arises from the difficulties of establishing thresholds of effects in complex physiological and ecological systems. Scientists are continually finding effects at lower levels of environmental stress than were noted previously. For example, the history of research on health effects of lead exposure follows this general pattern; this case is particularly relevant to the present study because the research eventually contributed to the phasing out of lead in gasoline. Research and policy on acid rain have a similar history.

Uncertainty may be compounded where there are cumulative effects from many sources over time. Thus, the environmental effects of emissions from intercity passenger transportation are part of the overall effects of transportation emissions generally, and of the effects of emissions from all sources. Furthermore, these emissions may be only one factor among several which determine physiological and ecological stress. In this case, intercity passenger transportation will be one among many contributors to environmental damage, and the appropriateness of policies to address environmental effects from this contribution must be judged with regard to the efficacy of policies for all contributions.

In the case of intercity passenger transportation, the major uncertainties are the effects of emissions on materials, biota and human health and comfort, and the effects of land uses on wildlife habitat and space available for other uses. Even if dose-response relationships or other measures of impact could be determined in experimental settings, there would still be great uncertainty about their implications on the magnitudes and geographical extents of impacts in the real world. It would be very difficult to distinguish the effects of different modes of transportation, especially where they make use of practically the same corridors.

The foregoing discussion of uncertainty has focussed on biophysical impacts. Apart from biophysical uncertainty, there is great uncertainty about future evaluations of environmental amenities. This is especially true over the course of generations, through which technologies may change, and the relative demands for resources and amenities may shift in one direction or another. It is thus very difficult to anticipate what combinations of natural capital and artificial capital will be most valued by future generations. As previously indicated, some economists (Krutilla and Fisher, 1985; Pearce and Turner, 1990) have offered reasonable arguments suggesting that the relative value of natural capital, especially life-support functions and amenities, is likely to increase in the future.

Because determining the social cost of environmental damage is of little practical value in itself, a third kind of uncertainty arises. In practice, the ultimate concern is the costs and potential benefits of policies to reduce and control environmental damage. There can often be considerable uncertainty about the efficacy of policies, and about the costs of implementing them. The importance of uncertainty about costs is indicated again by the policy processes with regard to acid rain and the phase-out of leaded gasoline. In both cases, the costs and efficacies of policies were one of the major areas of uncertainty impeding legislative or regulatory action. The same might be said about the current debate over greenhouse gas emissions and global warming.

### 7.1.5 Irreversibility

Evaluation becomes especially difficult (and many of the previous issues are compounded) in cases where there are environmental irreversibilities. An irreversibility is a permanent loss in an ecosystem component or in an ecosystem's capacity to maintain a particular function. For example, expansion of a highway or an airport might affect the habitat of a rare species. Emissions of greenhouse gases could also contribute to changes in global climate, which would be practically irreversible. Concerns about irreversibility arise mainly with regard to the former kind of discrete loss. Gradual losses of ecosystem functions, such as stratospheric ozone depletion and climate change, raise broader issues of environmental sustainability.

Clearly, if the value of preserving an ecosystem component or function is known, then the value of a development or activity must exceed this preservation value, if there is to be a net benefit from the development or activity when it incurs a loss of the preservation value. Often, however, preservation values are neglected, and there is undue optimism or over-estimation of the net benefits of development.

The problem of irreversibilities increases the salience of the question of intergenerational equity. Irreversible losses are incurred not only by the present generation, but also by all following generations. Often, however, only the present generation, or those in the near future, receive the benefits of the development or activity that imposes the environmental loss. The question therefore arises whether it is fair for the present generation to benefit at the expense of all succeeding generations. At the least, consideration needs to be given to the total economic and environmental legacy of the present generation for future generations.

The problem of irreversibilities is compounded by uncertainties about the values of ecosystem components or functions that are subject to irreversible loss. It is often difficult or impossible to know what the values of ecosystem components or functions are or will be. An often-cited example of this is a rare species or stock that could be the only source of a life-saving drug. A particular species could also have an unrecognized function in maintaining the balance of a whole ecosystem.

In the face of such uncertainties, the most risk-averse strategy would be to minimize the maximum losses that could occur. In this case, development would be a preferable option only if the costs of preservation, that is, the foregone development benefits, exceed these maximum possible losses from development. This approach would tend to correct any bias toward development and against preservation.

It may be difficult to keep track of all the ecosystem components and functions that human activities put at risk and the uncertainties about their values and probabilities of loss. Accordingly, it has been suggested (Ciriacy-Wantrup, 1952) that safe minimum standards should be developed so that irreversible losses of important ecosystem components and functions can be avoided. This approach has been elaborated in particular with regard to endangered species (Bishop, 1978).

## 8. THE POTENTIAL FOR RESEARCH TO IMPROVE THE PRECISION OF ESTIMATES

This report has provided a general overview and estimates of the environmental costs of intercity transportation. A number of difficulties and deficiencies in such estimation have been noted in previous sections. Here, some of these deficiencies are discussed with a view to the potential for research to improve the precision and reliability of estimates.

Attempts to improve the precision of estimates must address several layers of uncertainty. For example, with regard to emissions, there is uncertainty about each step from sources to fates and effects: quantities of emissions, transport and disposal, exposure, response and evaluation. Priorities for addressing uncertainties from emissions to response are discussed in general terms in the following subsection on biophysical estimates, and priorities for addressing uncertainties in evaluation are discussed in the subsection on economic estimates. These discussions lead to general recommendations for research priorities.

Two important limitations in these cost estimates have been mentioned previously, but bear prominent reiteration here. First, the cost estimates are all either average costs or marginal costs (that is, increments in costs for unit increments in emissions or resource use), given the current levels of emissions and environmental quality. For example, the costs of carbon dioxide emissions are based on the current costs of purchasing and afforesting land to take up the carbon dioxide through photosynthesis. Once the land currently available for this purpose is used up, the cost of more land to absorb additional carbon dioxide emissions is likely to be higher. Accordingly, the current average cost or marginal cost could be misleading.

Similarly, the marginal costs of environmental impacts can increase rapidly as ecological or physiological thresholds are approached. For example, some lakes may be little affected by acid precipitation until the buffering capacity of the surrounding watershed is depleted; then, acidification may be rapid. Again, current marginal costs could be misleading in such a case. Clearly, it is necessary to consider not only the costs of small, marginal changes, but also take account of biophysical limits and thresholds that might be breached in the longer term.

The second important limitation of the cost estimates presented here is that data were sparse for considering the complete life-cycle costs for each mode of transportation, including construction and maintenance of infrastructure, vehicle manufacture and disposal, fuel manufacture and distribution, and vehicle operation and maintenance. These front-end, or up-stream, costs could also include many subsidized and external costs, including environmental costs.

## 8.1 BIOPHYSICAL

### 8.1.1 Emissions

The emissions estimates in this report are based on existing regulations, typical fuel characteristics and average fuel efficiencies for each mode. For some modes — notably cars — emissions are determined largely by environmental regulations which are expressed in mass per unit distance (g/km); for other modes, emissions are estimated using the fuel efficiency (MJ/km) and unit emission rates (g/MJ) that reflect fuel characteristics. In the long term, choice of mode could also take into consideration the prospects for more stringent regulations, changes in fuel types or fuel characteristics (for example, alternative fuels or reduced sulphur content in diesel fuel) and improving efficiencies.

The comparative results for emissions, and hence costs, per passenger-kilometre are also very dependent on vehicle occupancy assumptions. Therefore, the prospects for future increases or decreases in vehicle occupancies also bear consideration.

### 8.1.2 Transport and Disposal

The cost estimates presented in this report have been derived mainly from cost studies for electric power generating facilities (Ottinger et al., 1990). Nevertheless, emissions from transportation have different chemical compositions and characteristics than emissions from power plants.

Sulphur dioxide and particulates have been the power plant emissions of greatest concern and have consequently received the greatest attention and rigour in evaluation. These emissions are of less concern for transportation compared to nitrogen oxides, hydrocarbons and carbon monoxide. These latter emissions have received less attention in impact assessment and evaluation.

Transportation emissions are generally released close to ground level, and may therefore have more concentrated local impacts. These would not be reflected in the estimates, which assume that transportation emissions undergo the same transport and disposal as electric power plant emissions. In fact, the impacts of air travel are likely to be concentrated near airports, of bus and car travel near roadways, and of train travel near rail lines. This is true not only for emissions, but also for land use impacts (such as the disturbance of wildlife habitat, modification of hydrological regime, and aesthetic considerations). The cumulative impacts of all these effects should be considered.

Finally, the altitude at which the pollutants are released may affect damage estimates. A recent study shows that the radiative forcing of surface temperature is most sensitive to changes in tropospheric ozone at a height of greater than 12 kilometres — the altitude at which the maximum emissions of nitrogen oxides from aircraft occur. The study concludes that the environmental damage of $NO_x$ emissions from aircrafts is about 30 times greater than from surface vehicles on a unit basis (Johnson, Henshaw and McInnes, 1992). The impact of release altitude on damage should also be considered.

### 8.1.3 Exposure

The concentration of transportation effects near transportation infrastructures means that exposure to impacts of transportation may be incurred, not only by nearby people, materials and ecosystems, but also by travellers, vehicles and transportation infrastructures themselves. Nevertheless, there is little research that directly measures exposures from transportation. Instead, estimates of exposure are based on ambient conditions. This may give an incomplete perspective on total exposure through multiple pathways.

Research is also lacking on behaviour to avert exposure to transportation externalities. It is therefore difficult or impossible to assess the costs and foregone benefits implied by this averting behaviour.

### 8.1.4 Response

Most of the estimates presented here depend critically on the direct cost method of damage estimation, and therefore on dose-response functions or damage functions relating total exposure to the incidence of particular effects and costs (that is, the effect for which a dose-response function or damage function must be clearly identifiable and measurable). This approach may neglect effects which are more subtle and less easily measurable, or for which the long-term costs are less obvious.

To establish that a response arises as a consequence of transportation or transportation emissions, it is necessary to substantiate each of the previous steps. At each step, the effects from transportation may be confounded with other effects. This may also limit the environmental costs that can be attributed to transportation.

The estimates quoted here indicate that human health is the category in which the greatest costs of emissions can be attributed. Visibility is the category with the next highest costs. Costs for several categories, notably forests and ecosystems, are not indicated. As pointed out by Ottinger et al. (1990, p. 553): "For all pollutants, valuation of ecosystem effects, wildlife, endangered species, and historical or cultural assets has been very limited. This is an important limitation that needs more attention." These costs are evident with regard to traffic in urban settings, but may be more difficult to discern for intercity transportation. Numerous studies have investigated roadside contamination by heavy metals from traffic, especially lead contamination when leaded gasoline was used (Freedman, 1989). The other metals are presumed to derive from vehicle wear. These metals have also been found to be accumulating in the floors of forests remote from roadways, but the ecological implications of this increasing contamination is not yet understood (ibid.).

Overall, these considerations suggest that efforts to improve estimates of the environmental costs of intercity transportation might be directed most usefully to assessment and evaluation of local impacts to supplement the estimates of the more widespread costs of emissions reported here. These local impacts could generally include the cumulative effects of emissions, land-use changes and aesthetic considerations. Although these impacts might be noted in environmental impact assessments (for example, for road improvements or airport expansions), there is usually no systematic attempt to evaluate their costs. Nevertheless, these impact assessments (or better, post-audits of impact assessments) might serve as starting points in determining some of the local environmental costs of transportation to supplement the estimates of the more widespread costs from emissions.

With regard to both local and distant impacts, greater attention needs to be devoted to irreversible changes, such as the accumulation of toxic contaminants and greenhouse gases, which have uncertain or unknown ecological or physiological consequences.

## 8.2 ECONOMIC

The estimates of environmental costs of transportation reported here are based mainly on studies, performed in the United States, of the direct costs of environmental damage from emissions. These estimates, and the assumptions underlying them, have not been thoroughly checked for their applicability to Canadian conditions. Such checking would be necessary before any reliance is placed on these estimates for Canadian policy.

When environmental or health damage occurs, the costs include any direct costs of averting or mitigating the damage *and* the residual welfare loss after the averting or mitigating behaviour. Although some degree of consistency has been achieved across evaluation studies for direct costs, such consistency has proven elusive for the costs of residual welfare loss. In the case of changes in risks of morbidity and mortality, in particular, there appear to be large discrepancies in how people evaluate risks, as determined by hedonic price methods, household production function methods and contingent valuation methods, especially between evaluations produced by different methods. Fundamental questions remain about applications of these methods, and the inferences that can be drawn legitimately from them, especially with regard to the evaluation of morbidity and mortality. Nevertheless, the costs of morbidity and mortality are a major component of the costs attributed to transportation emissions.

There are obvious gaps in the estimates with respect to some damage, especially potential damage to forests and ecosystems. This possible damage must be subject to further ecological research before economic assessment can provide quantitative estimates of costs. In qualitative terms, economic theory can only provide the guidance indicated earlier about the caution that is especially justified given both uncertainties and irreversibilities.

Nevertheless, the policy implications of the environmental impacts of transportation might be made clearer by a judicious selection of evaluation studies. These studies would apply some of the evaluation methods indicated here to at least some of the environmental costs that can reasonably be attributed to transportation. The attempts to estimate these costs would also help in identifying the gaps or uncertainties in biophysical knowledge that are most important for policy.

## 8.3 RECOMMENDATIONS

Although there is now a growing body of work evaluating the social costs of environmental damage in the United States and Europe, there has been as yet almost no original evaluation research conducted in Canada. This is the situation with regard to evaluation of environmental damage generally, and perforce with regard to evaluation of environmental damage from transportation.

Given this situation and the preceding discussion, there are three areas of support for evaluation research which appear to offer the greatest prospects of producing results that will be useful in the near term, while also promoting a general body of research and capabilities which can provide the basis for future advances.

First, even without full quantitative monetary evaluation, it would be very useful to set out the full range of possible environmental impacts from each transportation mode, using the complete life-cycle analysis advocated here.

Second, greater use could be made of quantitative evaluation in connection with environmental impact assessments of transportation projects or policies. Evaluation in environmental impact assessments of projects could help to indicate some of the local environmental costs, which could be extrapolated for inclusion in the total environmental costs to be considered in transportation policies.

Third, it might be particularly revealing, and at the same time provide results that people could most easily relate to, to conduct an evaluation of the environmental impacts of each transportation mode in a multimodal corridor. Windsor to Quebec City or Edmonton to Calgary might be suitable corridors for such a study.

Finally, outside the scope of evaluation of the environmental impacts of transportation, but relevant to its long-term prospects, consideration might be given to the sources of demand for transportation, and whether the social and environmental costs of transportation might be reduced (or perhaps even augmented) by the introduction of advanced telecommunications technologies.

## ENDNOTES

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The study team for the project at VHB consisted of David Heeney, Peter Stokoe, Murray Trott and Evelyn Nepom. David Heeney was the overall project manager. Peter Stokoe prepared the review of economic methodologies, Murray Trott prepared the assessment of emissions and their economic value, and Evelyn Nepom prepared sections on environmental effects and non-emission impacts.

1. *Canada's Green Plan* also identifies preserving the integrity of the North and environmentally responsible decision making at all levels of society as primary objectives.

2. The comparison of alternatives is fundamental to environmental assessment practice (and the rational planning model), and in principle considers the entire life cycle of each alternative. In practice, however, these have rarely been quantitative or comprehensive assessments of impacts.

3. Conceptually, material damage may be assessed in an analogous manner to health, based on exposure and dose-response considerations.

4. Note, however, that the net values of driving and going by bus might be different for society as a whole than for the person who makes the choice, because the social costs of the two choices include not only the private costs to the person but also the external costs of traffic congestion, environmental damage and other such costs that are borne by other members of society. It is the external costs component of social costs that are our main topic here.

5. Note that even breathing involves emitting "exhaust fumes" of carbon dioxide, a gas which contributes to global warming.

6. Such effects can occur not only through the natural environment, but also exclusively within the built environment, as with traffic congestion and accidents, but effects through the natural environment are the main subject of this report.

7. Note that although such costs are direct, they must often be inferred indirectly by means of dose-response functions or damage functions that relate environmental parameters to damage (for example, concentrations of sulphur dioxide and materials or crop damage). Some references (for example, Pearce and Markandya, 1989) distinguish evaluation methods primarily according to this interpretation of indirect and direct (that is, whether or not dose-response or damage functions are applied).

8. The actual emissions from plants vary according to the regulations in individual jurisdictions. Tougher regulations can effectively limit the choices of materials available to the manufacturer. For example, regulations limiting the emission of solvents have forced some car makers to abandon solvent-based paints in favour of waterborne paints.

9. Emissions per passenger-kilometre change proportionately with passenger occupancy. If vehicle occupancy for passenger rail transport doubled, the emissions per passenger-kilometre would decrease by one half. Estimates of vehicle occupancy are not explicit in the calculations made in this report and are not stated.

10. Parts of this section follow the discussion in Ottinger et al., 1990, p. 127.

11. A recent study suggests that CFC emissions may not contribute to global warming as previously thought. The holes in the stratospheric ozone layer resulting from CFC emissions may in fact cause a reduction in radiative forcing of the Earth in the middle to high latitudes. This reduction in radiative forcing may more than offset the warming effect of the CFC emissions. (World Meteorological Organization/United Nations Environmental Program, 1991).

12. Emissions from the source and background levels of pollutants both contribute to total exposure.

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# 14

# DEREGULATION AND COMPETITION IN THE CANADIAN AIRLINE INDUSTRY

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## I. INTRODUCTION

Any change in regulatory regimes is bound to affect the relevant industry. Airline deregulation is no exception. This report details the results of this study's measurement of the effects of airline deregulation in Çanada. In particular the assessment looks at how industry concentration, load factors (percentage of seats filled) and air fares have changed under deregulation.

Over the course of a decade, Canada relaxed regulation on its airlines until official deregulation began on January 1, 1988. Three data sets provide the basis for much of this assessment. First, the Airport Activity Data Base contains data on the passenger (and cargo) tra[illegible]lows into and out of Canadian airports. Second, the Revenue Passenger Origin and Destination Data Base is a 10-percent sample of passenger flight coupons. Finally, the Fare Basis Survey Data Base contains fare data from a 100-percent survey of passenger flight coupons conducted on 56 days of the year.

The intended methodology for this study was to begin with a time period before Canadian (and U.S.) deregulation to serve as a basis of comparison for future developments in Canadian aviation. Since the Fare Basis Survey did not begin until 1983 however, this was the first year used in this analysis. The year 1987 was selected as an intermediate year, with 1990 being the last year selected. The analysis pertains to Level I carriers.

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This report uses what could be called a *factual* methodology. That is, it chronicles the changes in the industry from 1983 to 1990. Some — perhaps most — of these changes may be due to regulatory reform. But observed changes could have nothing to do with airline deregulation and would have occurred anyway. The alternative methodological approach is a *counterfactual* one, where a model of how the regulated airline industry would have evolved (during the years of actual deregulation) is compared with the (actual) performance of the deregulated industry. Because this counterfactual model is a control, the observed differences between actual deregulation and counterfactual regulation can be attributed to deregulation. Unfortunately, developing a counterfactual methodology is beyond the scope of this study. Thus, care should be taken in interpreting the results presented below.

## II. INDUSTRY CONCENTRATION

When most people think about the effects of airline deregulation they think about its effect on fares. However, given the structure-conduct-performance paradigm that has been part of industrial organization for many years, industry structure (that is, the degree of concentration) is thought to affect fares. Thus, other things being equal, the fewer the number of competitors (that is, the more concentrated the industry), the higher the fares. (Fares and the effect of concentration on fares are examined in subsequent sections of this report.)

There are many ways to measure concentration in a network industry such as air transportation. First, there is concentration at the national level. This is an oft-cited figure when discussing the effects of airline deregulation. Typically one calculates a "concentration ratio," that is, the percentage of the market controlled by the *n* largest firms, where *n* is a number such as two, four or eight. These measures in Canada (and in the U.S.) show that the deregulated industry is more concentrated than it was before, in the sense that fewer firms control a large share of the national market. Note that there is no such thing as a national market. The markets for air transportation are the thousands of city-pair markets between which transportation takes place.[1] Thus, another measure of airline industry concentration is to measure concentration at the route level. Finally, because of the concern about a few airlines dominating hub airports, concentration can be measured at the airport level. In this case, concentration can be based on the percentage of passengers or flights controlled by each carrier at an airport. Alternatively, the extent of route-based concentration at an airport can be assessed by aggregating the route concentration of all routes originating at that airport.

In assessing the extent of industry concentration at the route level or airport level, the concept of "number of effective competitors" is used. The number of effective competitors is the inverse of the Herfindahl index. Rather than a simple count of the number of carriers in a market, the Herfindahl index adjusts for unequal market shares by summing the square of each airline's market share. Thus, if two airlines each had a 50 percent market share on a route, the Herfindahl index would equal $0.50^2 + 0.50^2 = 1/2$. Inverting the Herfindahl of 1/2 gives 2 (effective competitors). The inverted figure has a more intuitive interpretation than the Herfindahl index.[2]

Figure 1 shows industry concentration measured at the route level. Industry observers in Canada (and in the U.S.) point out that there are fewer airlines serving passengers today. Figure 1 indicates, however, that the number of effective competitors at the route level has increased from about 1.3 in the first quarter of 1983 (1983:1) to about 1.6 in the fourth quarter of 1990 (1990:4) and reached a peak of nearly 1.7 in the second quarter of 1987 (1987:2).[3]

Figure 2 presents the data on route concentration in a more intuitive way. It shows the percentage of passengers who fly on carriers with 90% or more route market share (that is, near-monopoly carriers). This fell from about 40% in 1983:1 to about 14% in 1990:4. Figure 3 shows the percentage of passengers who fly on carriers with 100% route market share (literally monopolies). The percentage of travellers captive to one carrier fell from about 26% in 1983:1 to about 7% in 1990:4. Similarly, Figure 4 shows the percentage of passengers on competitive carriers (those with route market shares less than 20%). This figure fell from around 6% percent in 1983:1 to about 3% in 1990:4.

*Figure 1*

INDUSTRY CONCENTRATION: ROUTE LEVEL

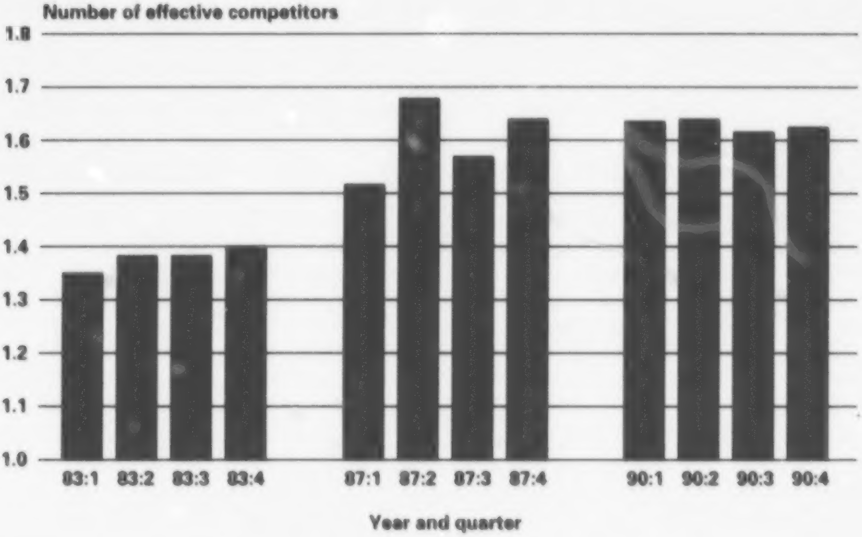


*Figure 2*

PERCENTAGE OF PASSENGERS FLYING ON CARRIERS WITH >90% ROUTE MARKET SHARE

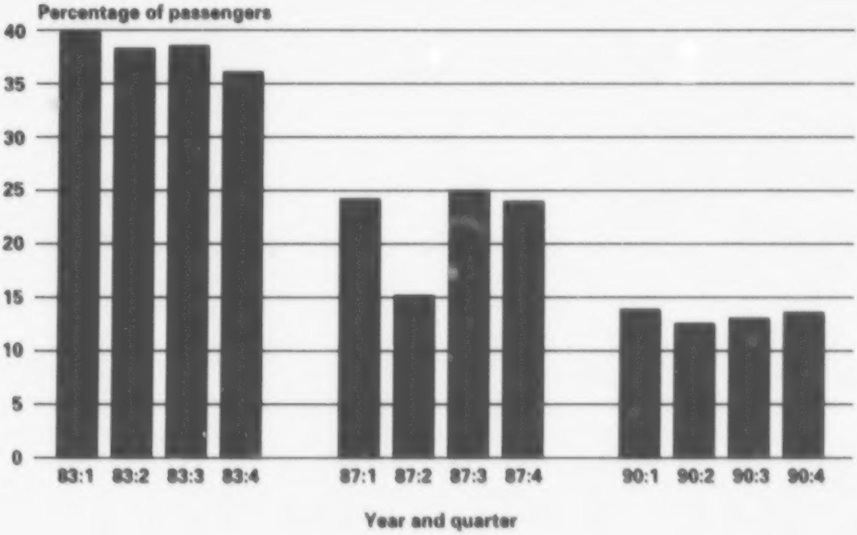


*Figure 3*

PERCENTAGE OF PASSENGERS FLYING ON CARRIERS WITH 100% ROUTE MARKET SHARE

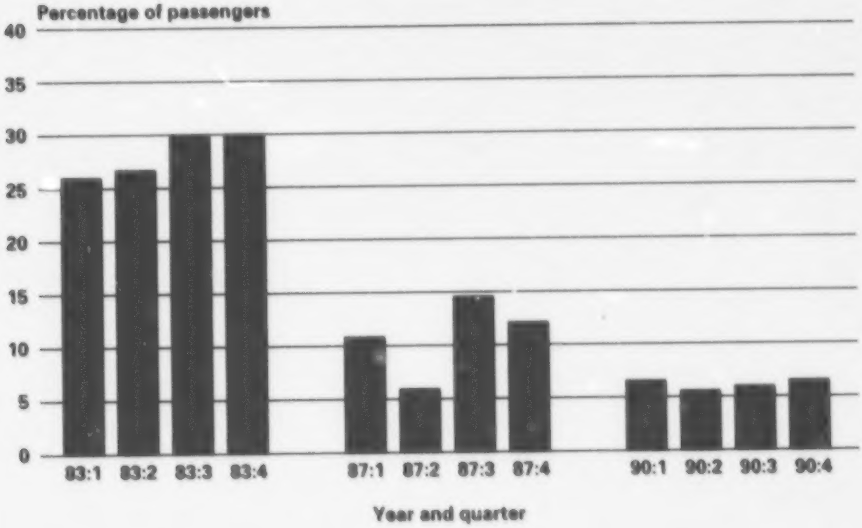
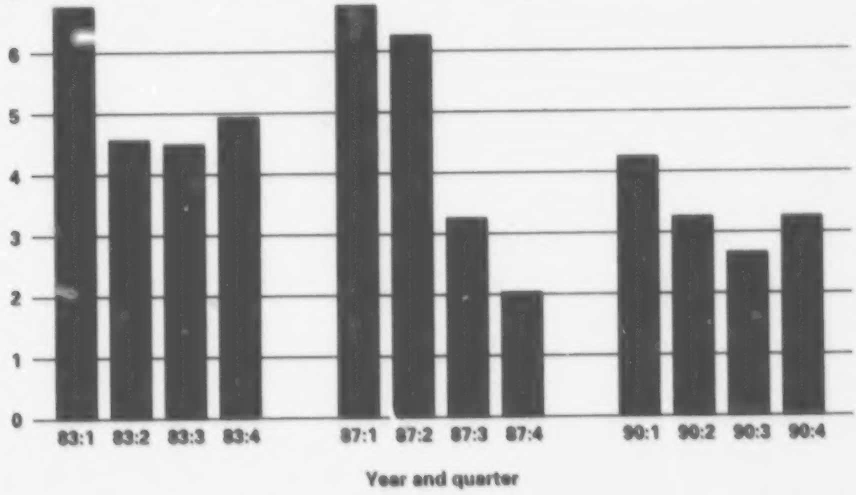


*Figure 4*

PERCENTAGE OF PASSENGERS FLYING ON CARRIERS WITH <20% ROUTE MARKET SHARE

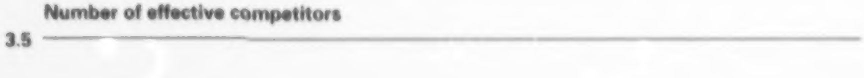


Although there were fewer airlines serving passengers in 1990 than in 1983, airlines competed more frequently at the city-pair level. The number of passengers with a wide choice of carriers declined by three percentage points, while the percentage of travellers captive to one airline declined by about 19 percentage points.

Another measure of industry concentration of interest is airport concentration. This measure of concentration may be relevant because if airports become more concentrated, it may be more difficult for other airlines to enter routes serving those airports. Figure 5 shows airport concentration based on enplanements and flights.[4] Using the enplanement measure, airport concentration has decreased, with the number of effective competitors rising from 2.2 in 1983:1 to nearly 2.7 in 1990:4. Using the flight-based measure, the number of effective competitors has increased from about 2.2 to about 2.4 during the same period. (These average figures may mask the diversity of changes at the individual airport level.)

*Figure 5*

*AIRPORT CONCENTRATION BASED ON ENPLANEMENTS AND FLIGHTS*



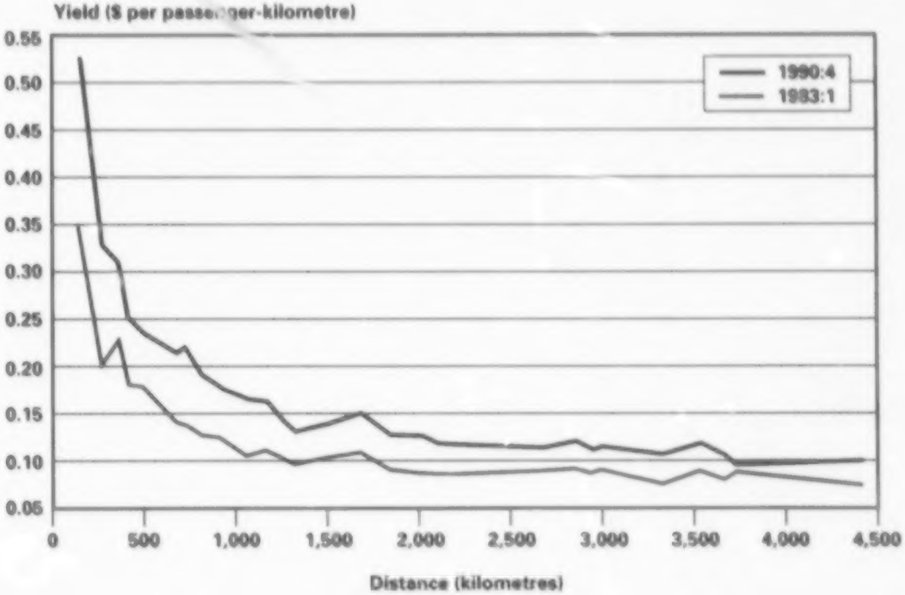
Overall, other than at the national level, the Canadian airline industry was, on average, less concentrated in 1990 than in 1983.[5] Of course, different routes and different airports have not shared equally. Some are less concentrated, while others are more concentrated.

## III. FARES[6]

The concentration information outlined in Section II suggests that fares under deregulation should be lower (in real terms) than previously. This section examines the relationship of fares in Canada over time as well as compared with the United States.

Figure 6 shows nominal yield (revenue per passenger-kilometre) as a function of distance in 1983:1 and 1990:4. The first aspect of this graph to notice is the fare "taper." Yield declines with distance, initially at a very rapid rate and then at a slower rate. This reflects (among other possible factors) the

*Figure 6*
*YIELD VS. DISTANCE*
*1983:1 AND 1990:4 (SOUTHERN)*



fixed costs of take off and landing, which, when amortized over longer distances, result in lower yields.

When comparing the yield curves for 1983:1 and 1990:4 it is difficult to see any trend, other than that nominal yields have risen. To get a better idea of fare changes, Figures 7 and 8 show the nominal and real percentage change in fares for several routes. Although a negative trend appears to be present, there is a lot of variation in fare changes across routes. The negative trend is more pronounced in Figures 9 (nominal) and 10 (real), which present average fare changes (averaged across various distance bands). As shown in Figure 10, real fares (using the CPI as the deflator) have risen for routes less than about 1,300 kilometres and have fallen for routes longer than about 2,100 kilometres.

*Figure 7*
AIR FARE CHANGES BY ROUTE FROM 1983:1 TO 1990:4

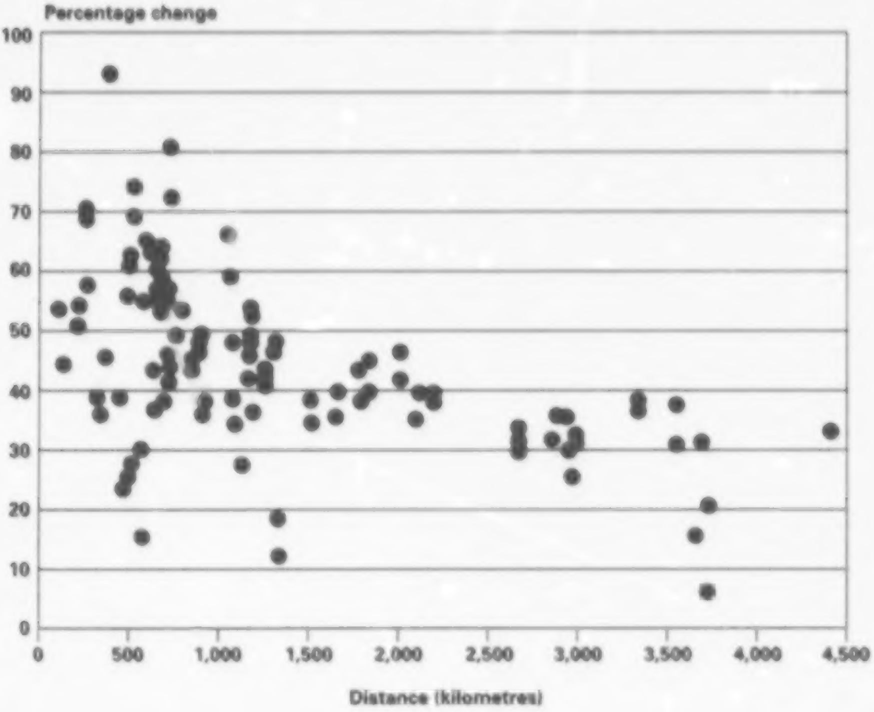
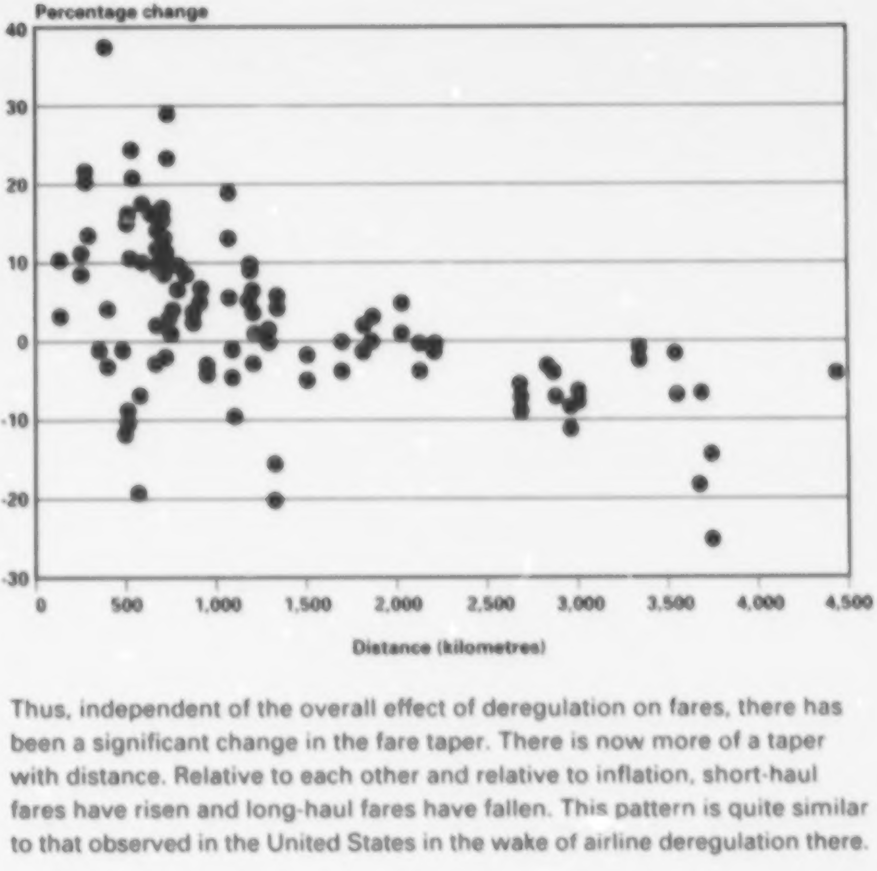


*Figure 8*

REAL AIR FARE CHANGES BY ROUTE FROM 1983:1 TO 1990:4



Thus, independent of the overall effect of deregulation on fares, there has been a significant change in the fare taper. There is now more of a taper with distance. Relative to each other and relative to inflation, short-haul fares have risen and long-haul fares have fallen. This pattern is quite similar to that observed in the United States in the wake of airline deregulation there.

Figures 11 and 12 show the relationship of fares in Canada to fares in the United States as a function of distance for 1983:1 and 1990:4.[7] In both years, Canadian air fares were lower than U.S. air fares for short-distance flights (less than about 1,500 kilometres) and greater than U.S. fares for long flights. Since many factors other than distance affect fares (for example, route density, load factor) one cannot conclude from these figures that Canadian long-haul fares are too high (or that U.S. short-haul fares are too high). In fact, the result that short-haul fares in Canada were, and remain, lower than U.S. air fares for the same distances may only reflect an anomaly

*Figure 9*

PERCENTAGE CHANGE IN AIR FARES BETWEEN 1983:1 AND 1990:4 (SOUTHERN)

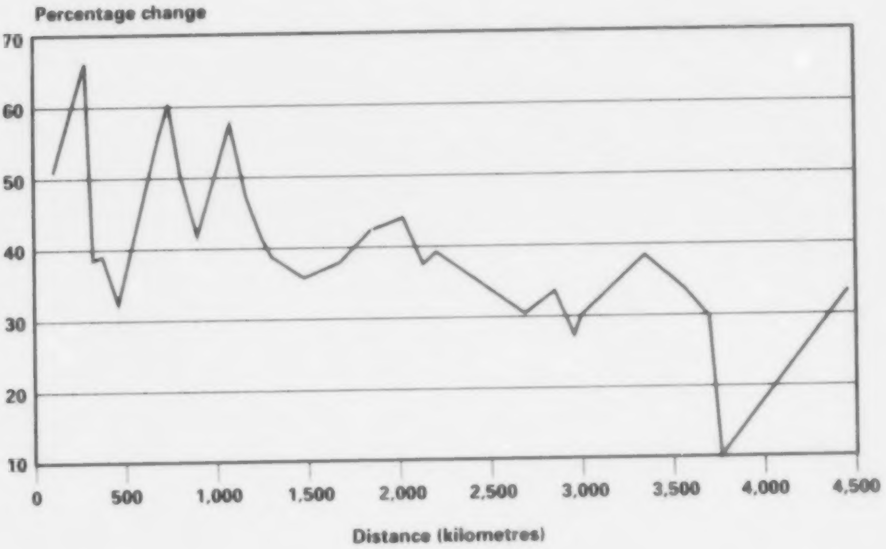


*Figure 10*

PERCENTAGE CHANGE IN REAL AIR FARES BETWEEN 1983:1 AND 1990:4 (SOUTHERN)

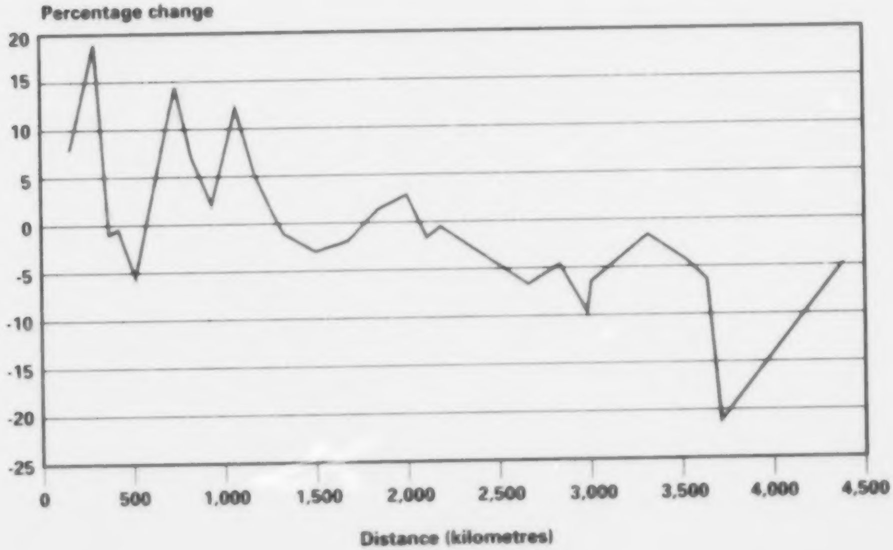


*Figure 11*

RELATIONSHIP OF CANADIAN AIR FARES TO U.S. AIR FARES IN 1983:1

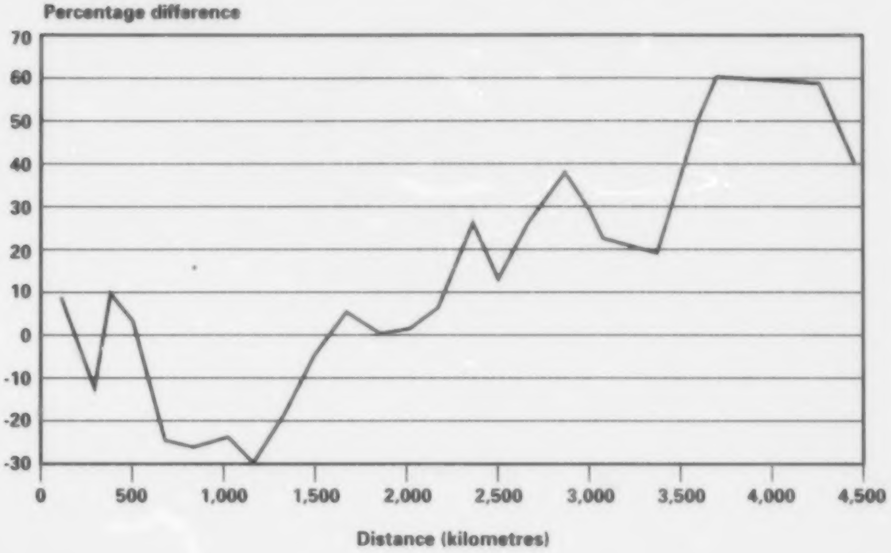
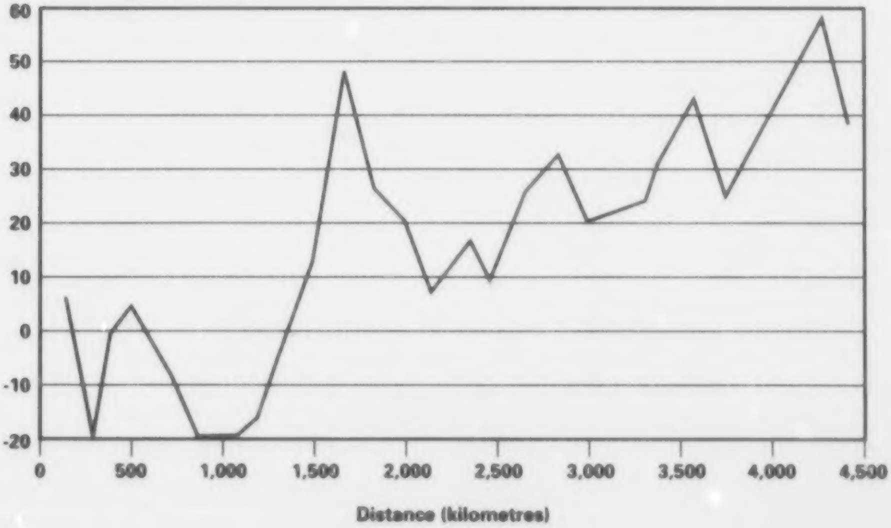


*Figure 12*

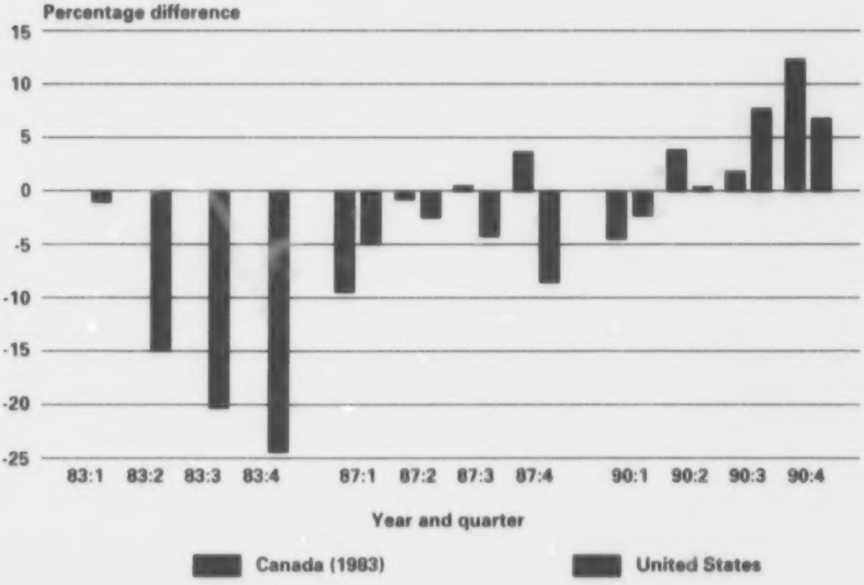
RELATIONSHIP OF CANADIAN AIR FARES TO U.S. AIR FARES IN 1990:4



in the Canadian fare data. If a passenger's journey from A to B involves a connection at point C, the Fare Basis Survey allocates the A–B fare to the segments A–C and C–B. For example, if a passenger flew from Vancouver to Toronto and made a connection at Winnipeg, the Fare Basis Survey would (effectively) show the short-haul Vancouver–Winnipeg and Winnipeg–Toronto legs as having a low yield that should more appropriately be assigned to the long-haul Vancouver–Toronto segment. How much of the observed pattern is due to this anomaly is difficult to say.

Figure 13 presents an attempt to estimate how fares in Canada have changed over time, relative to the fares that prevailed in Canada in 1983 and relative to those in the U.S. in the corresponding year and quarter. In particular, each coupon in the Fare Basis Survey was used as the basis for figuring out what was actually paid for a given trip (that is, segment). This was compared with what would have been paid had the real fares prevailing in Canada in 1983 (for the same distance) been charged. Also, actual fares were compared with those that would have been paid if passengers paid the fares charged in the U.S. (adjusted to reflect the exchange rate) for the same distance during the same year and quarter.

*Figure 13*
*AIR FARES IN CANADA RELATIVE TO COMPARISON GROUPS*



In 1987, fares in Canada were nearly 10% lower in 1987:1 than they were in 1983:1. Over the course of 1987, relative fares increased; by 1987:4 fares were nearly 4% higher than they were in 1983:4. In 1990:1 fares were nearly 5% lower than fares in 1983:1. By 1990:4 relative fares increased to nearly 13% higher than in 1983:4.

The figure also compares fares in Canada with those in the U. S. Due to the anomaly in the Canadian data discussed above, however, *these figures must be interpreted with caution*. Based on these results, fares in Canada were nearly 25% lower than U.S. air fares in 1983:4. By 1990:4 they were about 7% higher than U.S. air fares.

Because of the caveat above, it is difficult to put much credence in the Canada-U.S. comparison. In Canada-Canada inter-temporal comparisons, any bias should cancel out. If the fourth quarter of 1990 is treated as an anomaly due to the Persian Gulf Crisis, it can be concluded that, when compared with 1983, Canadian airline deregulation did not change the level of fares very much, but significantly changed the structure (with distance). Presumably this changing structure makes the variation of fares with distance more in line with the variation in costs.

These results are at odds with those of Oum et al. (1991)[8] who reported that Canadian air fares declined by 18% in real terms between 1983 and 1989 (the last year they were studied). What accounts for the discrepancy? First, it appears that the figures in Oum et al. were for all operations of Canadian air carriers. In particular, it appears that they included northern and southern domestic Canadian traffic, transborder traffic and international traffic. The figures in this study relate only to southern (deregulated) domestic Canadian traffic. Second, because they used aggregate data and were thus forced to focus on (average) yield, Oum et al. picked up some of the effect of the changing composition of routes in the sample. For example, as short routes become (relatively) more expensive and long routes become (relatively) cheaper in the wake of deregulation, one would expect the deregulated era to contain a larger proportion of long trips than the regulated era. Indeed, even holding constant the routes in question, as in Figure 7, the average length of haul (passenger-kilometres per passenger) increased to 1,381 kilometres in 1990:4 from 1,193 kilometres in 1983:1. Since the coefficient of the log of distance in the fare regressions (see below) is approximately 0.5, the change in the distribution of trips alone would lower (average) yield by about 7% even if fares on each route remained constant. In particular, using the routes represented in Figure 7, comparing the yield in 1983:1 with the yield in 1990:4 reveals a nominal increase of 31.5% and a real decrease of 6.3%. When the weight attached to each route was held constant, however, the average yield increased by 38.8% (with 1990:4 weights) and 40.1% (with 1983:1 weights). Real fares decreased by 1.1% with 1990:4 weights and by 0.2% with 1983:1 weights.

Another issue relating to fares is their distribution on each route. Table 1 shows the percentage of passengers in each of eight fare classes in 1983:1 and 1990:4.[9] The most dramatic change in the table is in the changes in the proportions of regular economy and advanced purchase fares. Over 50% of travellers in 1983:1 flew on a regular economy fare. By 1990:4 this had fallen to less than 25%. Advanced purchase fares show the opposite pattern. About one quarter of travellers flew on advanced purchase fares in 1983:1. By 1990:4 over one half of passengers availed themselves of the discounts available by making reservations and purchasing tickets in advance. During this time the depth of the discount of advanced purchase fares relative to regular economy fares increased to 37% from 24%.

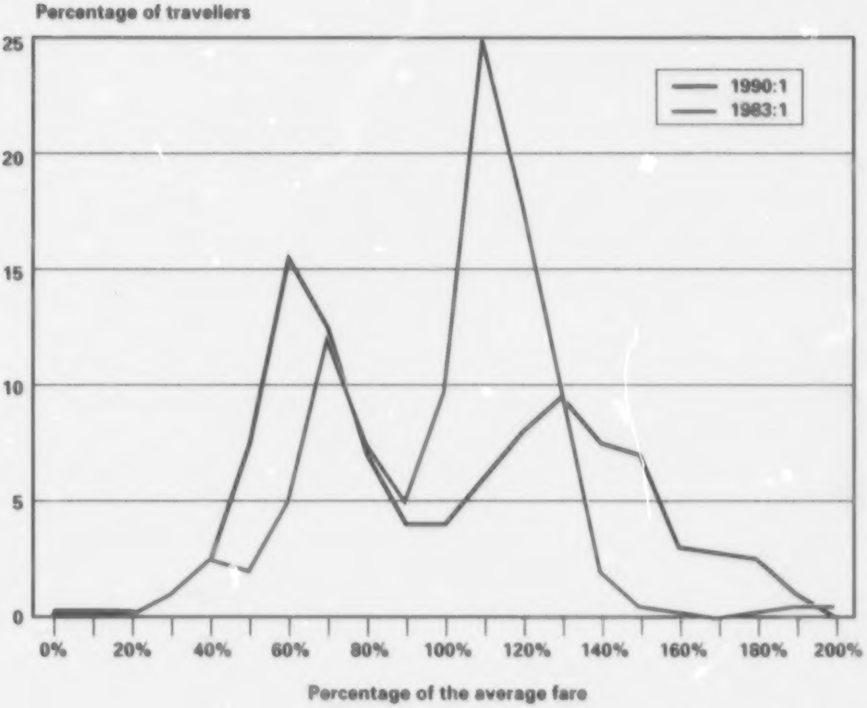
*Table 1*

PERCENTAGE OF PASSENGERS BY FARE CLASS

| Fare Class | 1983:1 | 1990:4 |
|---|---|---|
| First class | 0.7 | 0.3 |
| Regular economy | 56.4 | 23.6 |
| Advanced purchase | 28.8 | 52.0 |
| Non-advanced purchase | 7.6 | 13.1 |
| Other | 0.1 | 0.6 |
| Industry and agency discount | 1.0 | 1.5 |
| Unknown | 5.3 | 1.5 |
| Business class | 0.0 | 7.6 |

The proliferation of advanced purchase discount fares raises the question of the distribution of fares on each route. Figure 14 looks at the change in fare distribution. It plots the distribution of fares around each route's average for 1983:1 and 1990:1. The fare structure was bimodal in 1983:1 and remained bimodal in 1990:1. However, the fare structure was more dispersed in 1990:1 than in 1983:1. This could be because airlines erected "fences" and priced based on willingness to pay (that is, demand elasticity). Alternatively, prices could be based on costs, in which peak-period flights and on-demand service are more costly to provide. Most likely, both factors are influencing the increased spread of fares.

Figure 14
DISTRIBUTION OF AIR FARES



# IV. LOAD FACTORS

Load factor is the percentage of seats occupied by paying passengers. From the point of view of passenger convenience, low load factors are good because the lower the load factor, the more likely a passenger can get a seat on the flight that he or she desires. On the other hand, since airlines must recover their costs from the passengers they carry, the higher the load factor, the lower the fare. The optimal load factor reflects a trade-off between these two conflicting components. The optimal load factor rises with distance (other factors being constant). Because long-distance flights are more expensive than short-distance flights, it is optimal to have fewer excess seats.

Figures 15 through 22 show load factor comparisons as a function of distance for each quarter in 1983 with the corresponding quarter in 1990. The first graph of each pair shows the load factor for each of the years. The second graph shows the percentage change in the load factor. In all cases, load factors rise with distance. In comparing the first three quarters of 1983 with the corresponding quarters in 1990, load factors fell for short-distance flights and rose for long-haul flights. This is consistent with the fare changes: up for short-haul flights and down for long-haul flights. This pattern disappears in comparisons of the last quarter in 1983 with the corresponding quarter in 1990. Whether this reflects the evolution of deregulation or anomalies of the Persian Gulf Crisis remains to be seen. Thus, at least through the first three quarters of 1990, passengers paid higher fares for short-haul flights but found it easier to get a seat on the flight of their choice. Long-haul fares fell but it was harder to find a seat.

*Figure 15*

*Relationship of Load Factor to Distance in 1983:1 and 1990:1*

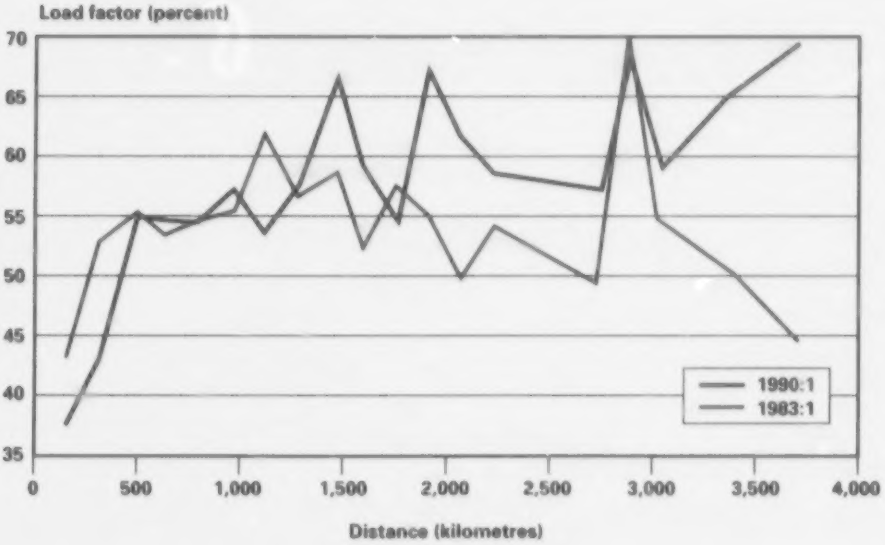


Figure 16

PERCENTAGE CHANGE IN LOAD FACTOR BETWEEN 1983:1 AND 1990:1

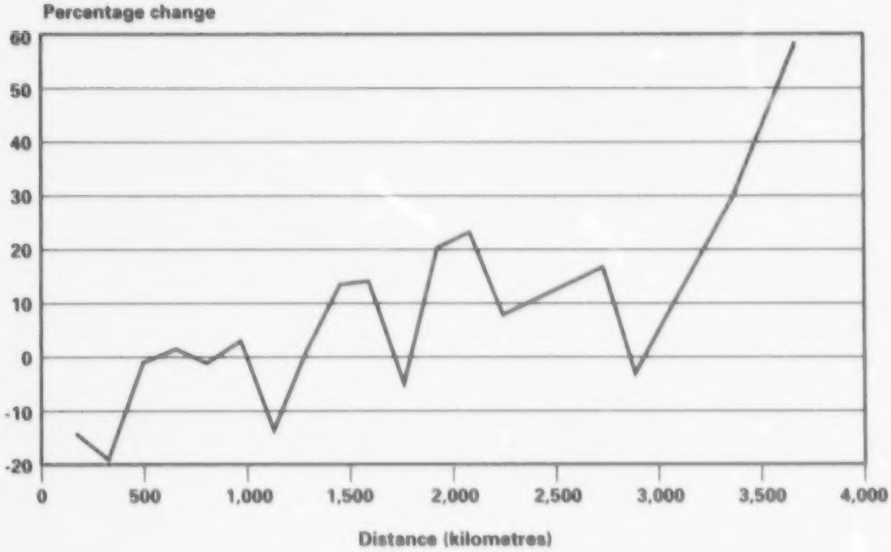


Figure 17

RELATIONSHIP OF LOAD FACTOR TO DISTANCE IN 1983:2 AND 1990:2

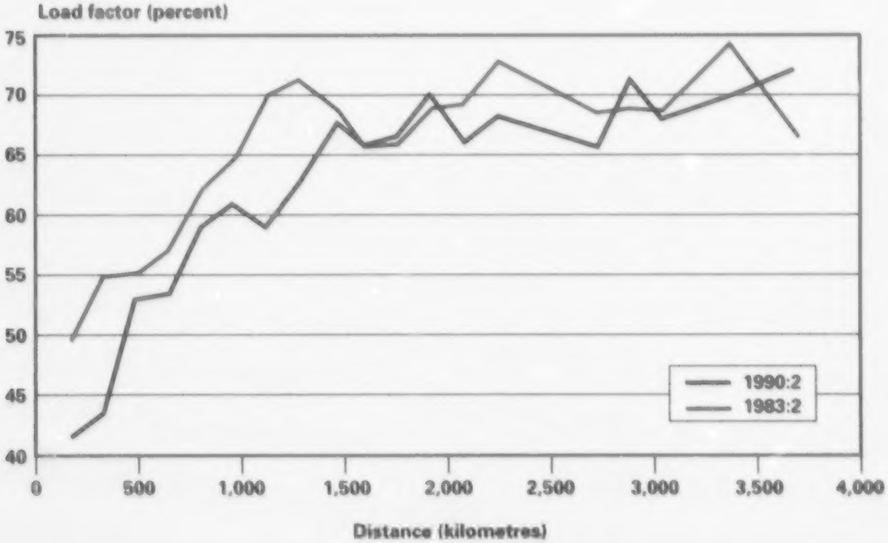


*Figure 18*

PERCENTAGE CHANGE IN LOAD FACTOR BETWEEN 1983:2 AND 1990:2

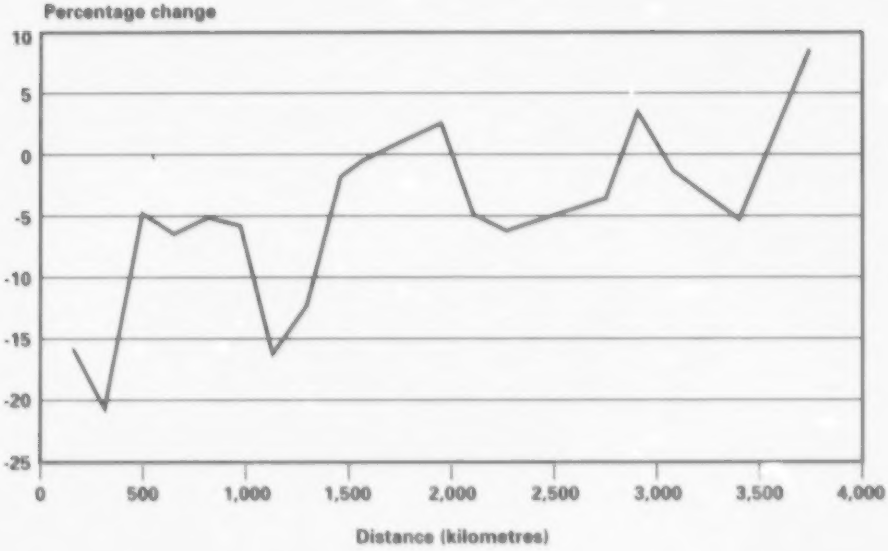


*Figure 19*

RELATIONSHIP OF LOAD FACTOR TO DISTANCE IN 1983:3 AND 1990:3

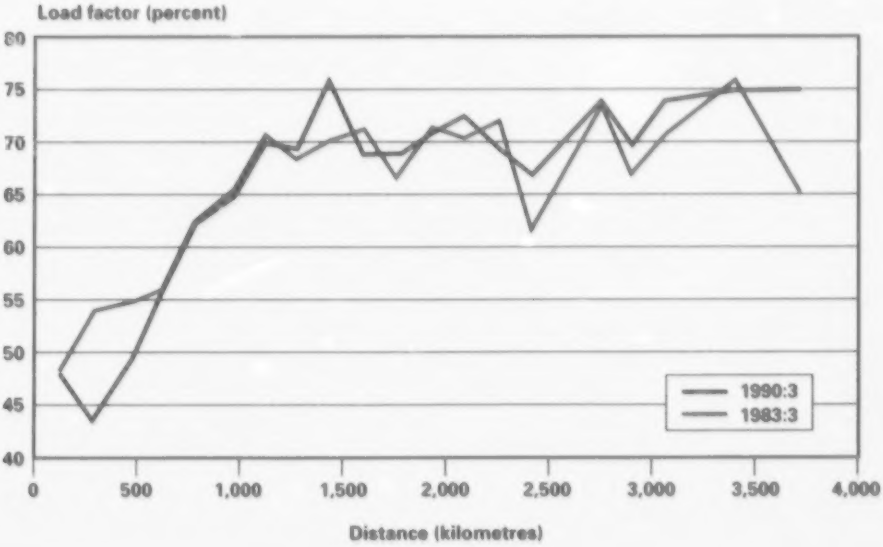


*Figure 20*

PERCENTAGE CHANGE IN LOAD FACTOR BETWEEN 1983:3 AND 1990:3

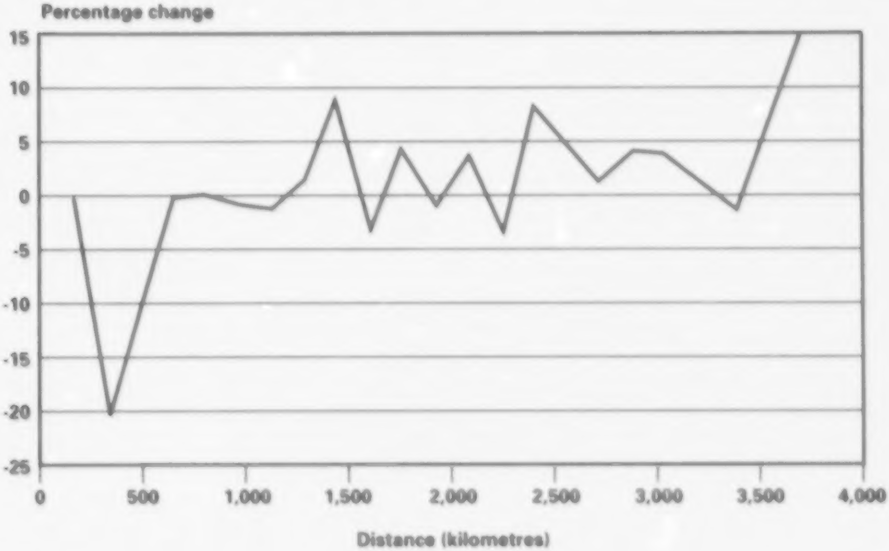


*Figure 21*

RELATIONSHIP OF LOAD FACTOR TO DISTANCE IN 1983:4 AND 1990:4

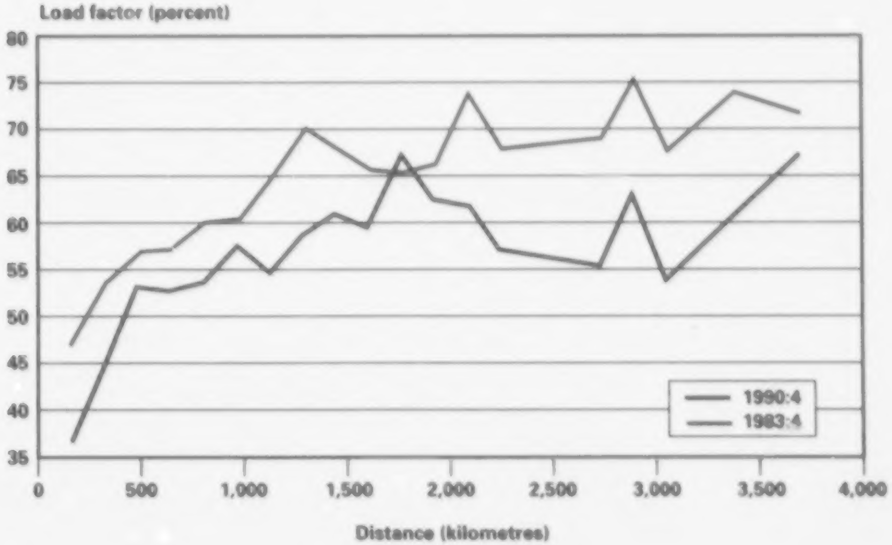
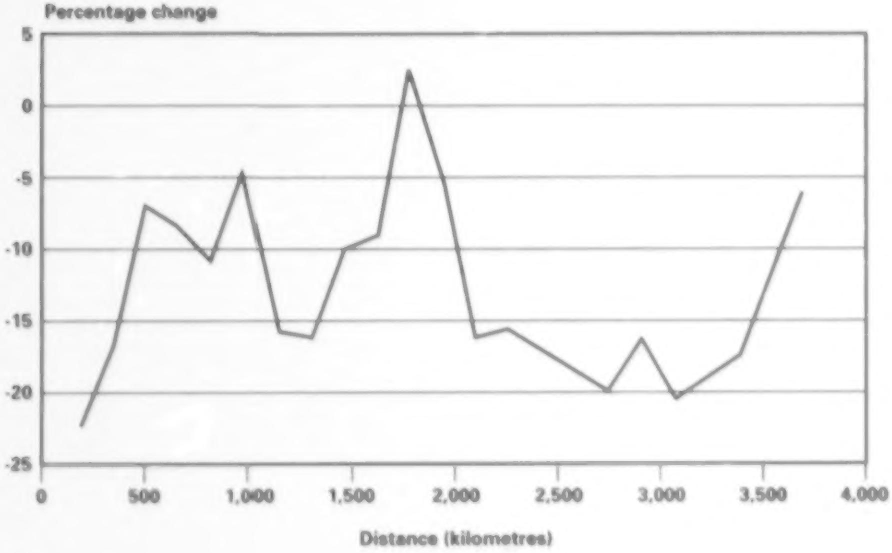


*Figure 22*

PERCENTAGE CHANGE IN LOAD FACTOR BETWEEN 1983:4 AND 1990:4



## V. FARE REGRESSIONS[10]

The previous sections presented data on what has happened to route concentration, airport concentration and air fares since 1983. This section amalgamates those pieces and attempts to explain air fares on each route as a function of the concentration variables, a route density variable and distance, for 1983, 1987 and 1990.

The data sources for these regressions are the same as those used already in this study: Fare Basis Survey Data Base (for fares), Airport Activity Data Base (for airport concentration) and Revenue Passenger Origin and Destination Survey (for route concentration). The Fare Basis Survey is completed and filed by Canadian Level I air carriers operating scheduled passenger service, both domestic and international. In 1983, Air Canada, CP Air, Eastern Provincial Airways, Nordair and Pacific Western Airlines participated in the Fare Basis Survey. In 1987, Air Canada, Canadian Airlines International and Wardair participated. In the 1990 survey, Air Canada and Canadian Airlines International participated. The routes included in the analysis were all domestic routes (for which data were available) in the deregulated southern sector. For a city-pair route to be included in the reported regressions, appropriate data for that route and for its end points had to be available in all three data bases. Given that two of the data bases are samples from a larger population, there were some cases where routes had to be dropped because of lack of data.[11]

Table 2 reports the results of a cross-section regression of fare in 1983 on distance (LDIST), a measure of route concentration (LACTRTE),[12] a measure of airport concentration at the origin (LCOMPO) and destination (LCOMPD),[13] and a measure of route density (LPOPPOP).[14] A measure of route density is needed because, other things being equal, as route density increases, fares are expected to fall and more competitors are expected on high-density routes. Failure to control for route density may result in route density being captured by the coefficient of the competition variable, resulting in a route competition coefficient that is larger in magnitude than the true effect of competition on fares. The variable used here, while not a direct measure of route density, does not suffer from being endogenous, as would a direct measure of route density, for example, the number of passengers travelling on that route.

The first equation shows that fares increase with distance, although less than proportionally (reflecting the fare taper). Also, as the number of effective competitors on a route increases (LACTRTE), fares decrease. Since the equation is in logarithms, the -0.0507 coefficient indicates that a 1% increase in the number of effective competitors on a route reduces fares by 0.0507%. This coefficient is statistically significant at conventional significance levels. Neither of the airport concentration variables (LCOMPO, LCOMPD) is statistically significant. The route density variable (LPOPPOP) is negative and statistically significant indicating that as route density (that is, the product of the populations of the origin and destination) increases by 1%, fares decline by 0.0177%. Collectively, these variables explain 86.1% of the variation in (the log of) fares. Distance alone explains 85.4%.

*Table 2*

*Fare Regression for 1983*

```
LS // Dependent Variable is LFARE
SMPL range: 1-1,955
Number of observations: 1,955
  VARIABLE         COEFFICIENT       STD. ERROR        T-STAT.         2-TAIL SIG.
  C                 1.5148964        0.0311806        48.584731          0.0000
  LDIST             0.5086341        0.0050752       100.22025           0.0000
  LACTRTE          -0.0507408        0.0194973        -2.6024466         0.0093
  LCOMPO           -0.0010721        0.0104145        -0.1029449         0.9180
  LCOMPD            0.0066027        0.0103955         0.6351446         0.5254
  LPOPPOP           0.0177170        0.0025000        -7.0867148         0.0000
---------------------------------------------------------------------------------
R-squared              0.860949          Mean of dependent var.        4.680293
Adjusted R-squared     0.860592          S.D. of dependent var.        0.465855
S.E. of regression     0.173938          Sum of squared resid.         58.96593
Log likelihood         648.3842          F-statistic                   2413.482
Durbin-Watson stat     1.964760          Prob(F-statistic)             0.000000
```

Table 3 shows the results for the same specification for 1987. No variable, except distance, is statistically significant, and all coefficients, except route density and distance, have the "wrong" sign. Collectively, these variables explain 61.5% of the variation in (the log of) fares. Distance alone explains 61.4%.

Finally, Table 4 presents regression results for 1990. Once again, only distance and the route density variable are statistically significant. Collectively, these explanatory variables account for 79.1% of the variation in (the log of) fares. Distance alone explains 78.2%.

Because it is possible that more observations would lead to more precisely estimated coefficients, the data for 1987 and 1990 were pooled and a single regression was estimated with dummy variables for each year serving as "intercepts." These results are reported in Table 5. Unfortunately, they differ very little from the separate results for the two years.

*Table 3*

*Fare Regression for 1987*

```
LS // Dependent Variable is LFARE
SMPL range: 1-1,546
Number of observations: 1,546
 VARIABLE        COEFFICIENT      STD. ERROR        T-STAT.       2-TAIL SIG.
 C                 1.7161864      0.0722403       23.756617        0.0000
 LDIST             0.4608607      0.0103730       44.428721        0.0000
 LACTRTE           0.0128799      0.0335448        0.3839607       0.7011
 LCOMPO            0.0307646      0.0193679        1.5884307       0.1124
 LCOMPD            0.0305367      0.0193790        1.5757625       0.1153
 LPOPPOP           0.0048699      0.0057713       -0.8438266       0.3989
-----------------------------------------------------------------------------
R-squared              0.615462       Mean of dependent var       4.818028
Adjusted R-squared     0.614213       S.D. of dependent var       0.521164
S.E. of regression     0.323704       Sum of squared resid      161.3677
Log likelihood      -446.8992         F-statistic               492.9805
Durbin-Watson stat     1.973949       Prob(F-statistic)           0.000000
```

*Table 4*

*Fare Regression for 1990*

```
LS // Dependent Variable is LFARE
SMPL range: 1-754
Number of observations: 754
 VARIABLE        COEFFICIENT      STD. ERROR        T-STAT.       2-TAIL SIG.
 C                 1.8991473      0.0885634       21.443923        0.0000
 LDIST             0.5124343      0.0103094       49.705524        0.0000
 LACTRTE           0.0408411      0.0416958        0.9795019       0.3276
 LCOMPO            0.0369906      0.0271501        1.3624462       0.1735
 LCOMPD           -0.0215412      0.0271244       -0.7941638       0.4274
 LPOPPOP          -0.0313062      0.0078153       -4.0057451       0.0001
-----------------------------------------------------------------------------
R-squared              0.790645       Mean of dependent var       5.108579
Adjusted R-squared     0.789245       S.D. of dependent var       0.517822
S.E. of regression     0.237722       Sum of squared resid       42.27066
Log likelihood        16.37009        F-statistic               564.9753
Durbin-Watson stat     1.890526       Prob(F-statistic)           0.000000
```

*Table 5*

*FARE REGRESSION FOR 1987 AND 1990 (POOLED)*

```
LS // Dependent Variable is LFARE
SMPL range: 1-2,300
Number of observations: 2,300
  VARIABLE        COEFFICIENT      STD. ERROR        T-STAT.        2-TAIL SIG.
  D87               1.6794516       0.0554100       30.309522         0.0000
  D90               1.9107242       0.0585146       32.653812         0.0000
  LDIST             0.4792344       0.0076954       62.275472         0.0000
  LACTRTE           0.0313808       0.0262754        1.1943023        0.2325
  LCOMPO            0.0291124       0.0157870        1.8440745        0.0653
  LCOMPD            0.0140270       0.0157869        0.8885218        0.3744
  LPOPPOP          -0.0129064       0.0046296       -2.7877905        0.0054

R-squared              0.690728          Mean of dependent var.     4.913278
Adjusted R-squared     0.689919          S.D. of dependent var.     0.537556
S.E. of regression     0.299338          Sum of squared resid.      205.4600
Log likelihood        -485.8338          F-statistic                853.5311
Durbin-Watson stat     1.950103          Prob(F-statistic)          0.000000
```

What are we to make of these results for the functioning of deregulated Canadian airline markets? Perhaps the most interesting result is that route competition does not have a statistically significant effect on fares. Unfortunately, the interpretation of this result is ambiguous. If these markets were (perfectly) contestable, route level competition would not have an effect on fares (because the threat of entry would force incumbents to keep their prices down). The same result would be expected, however, if the industry were a cartel. But profit data show no hint of monopoly rents. Another possibility is that the industry is still in transition (1990 was a recession year, and fuel prices increased during the Persian Gulf Crisis).

## VI. CONCLUSIONS

It is clear that, on average, deregulation has increased the extent of competition at the route level and at the airport level (although it has declined at the national level). It is also clear that the structure of fares (with respect to distance) has changed, presumably to one more in line with the costs of production. Load factors have changed accordingly, falling on short routes and rising on long routes. These changes are consistent with market behaviour. It appears, however, that deregulation has had a neutral effect on the overall level of fares (when compared with Canadian air fares in 1983).

Route-level competition does not affect fares. Although this is consistent with a cartel, profit data show no hint of monopoly rents. The results are also consistent with a contestable or competitive market. The poor profitability of the industry suggests that this interpretation should be seriously considered.

## ENDNOTES

1. Because of this, in calculating the percent of the national market controlled by each firm, analysts must aggregate the city-pair level outputs into a single national output. Typically, this is done by calculating the number of passenger-kilometres (or passengers) transported on each route and summing across routes.

2. Likewise, if one firm had two thirds of the market and two other firms each had one sixth of the market, the Herfindahl index would also equal 1/2. In other words, even though there are three firms in the industry, the relative size of the largest firm makes the industry behave as if it had only two firms.

3. In this case, effective competitors is the inverse of a passenger-weighted average of each route's Herfindahl index. Figures 1 to 5 were calculated from data in the Revenue Passenger Origin Destination Data Base (ticket origin destination).

4. The data for these figures are from the Airport Activity Data Base. Airport-based Herfindahl indices were calculated using share of enplanements and share of flights. These measures for each airport were then weighted by percent of total enplanements or flights, as appropriate. The number of effective competitors is the inverse of this figure.

5. Although competition takes place at the route level and not the national level, there is a concern that, as the number of carriers declines nationally, the possibility of collusion (at the route level) increases.

6. All fare data in this section relate to domestic Canadian services in the southern sector.

7. The exchange rate prevailing at the time of the comparison (that is, 1983:1 and 1990:4) was used to convert U.S. dollars to Canadian dollars.

8. Tae Oum, William Stanbury and Michael Tretheway, "Airline Deregulation in Canada," in *Airline Deregulation: International Experiences*, edited by Kenneth Button, (London: David Fulton, 1991).

9. These results are from the Fare Basis Survey and include only domestic Canadian routes in the southern sector flown by Level I carriers. Only those routes represented in the sample in all quarters of 1983, 1987 and 1990 were included.

10. The variables used in the regressions reported in this section are the natural logarithms of those discussed in the text.

11. The fare regression for 1990 reported in Table 4 has about one half of the observations (routes) as the 1987 regression. These were all the routes for which complete data were available. Presumably the routes formerly served by Level I carriers and now served by their (commuter) affiliates are not part of the Fare Basis Survey.

12. This is the "number of effective competitors" (that is, the inverted Herfindahl index based on passenger shares) for each route in question.

13. Each of these airport measures represents the number of effective competitors at the origin and destination airports, respectively. In particular, these measures are the inverse of the origin and destination airports' Herfindahl indices based on passenger enplanement (both domestic and international) shares.

14. This is the product of the populations of each end point on the route.

## 15

# THE EFFECTS OF U.S. AIRLINE DEREGULATION: A REVIEW OF THE LITERATURE

Ron Hirshhorn*
December 1990

## 1. BACKGROUND

Prior to the mid-1970s, interstate airlines in the U.S. were subject to a comprehensive framework of controls.[1] The Civil Aeronautics Board (CAB) controlled entry and exit, regulated fares, administered subsidies and oversaw mergers and intercarrier agreements. Under its own initiative the CAB liberalized fare regulation beginning in 1976.[2] Two years later, in October 1978, Congress passed the *Airline Deregulation Act*. This formally acknowledged the need to place "maximum reliance on competitive market forces" and set in place a process for the gradual dismantling of regulatory controls. Since 1982, air carriers have had virtually complete freedom of market entry and exit. The CAB lost control over rates, mergers and acquisitions on January 1, 1983, and it ceased operation entirely at the end of 1984. The Department of Transportation assumed responsibility for approving mergers and for administering a subsidy program (the Essential Air Service Program) to guarantee service to small communities.[3] Safety regulation was not affected and was retained at the Federal Aviation Administration (FAA).

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## 2. GENERAL EFFECTS: OVERVIEW

The consensus in the literature is that, based on the most important criterion, the effect on consumer welfare, U.S. deregulation has been highly beneficial. The prevailing view is summarized in a recent paper by Alfred Kahn (1988a, p. 321) which acknowledged a number of "unpleasant surprises," but then came to the following conclusion:

> The last ten years have fully vindicated our expectations that deregulation would bring lower fares, a structure of fares on average in closer conformity with the structure of costs, an increased range of price-quality options, and great improvements in efficiency . . . all this along with a 35 percent or so decline in accident rates.

In what is, probably, the most widely cited study of U.S. experience, Steven Morrison and Clifford Winston (1986) estimated that, taking account of both fare and quality of service changes, deregulation has resulted in a $5.7 billion (in 1977 dollars) annual improvement in the welfare of consumers. This welfare gain, which amounted to 35 percent of actual airline revenues in 1977, translated to a benefit of $10.62 per traveller per round trip. In addition, deregulation was estimated to have led to at least a $2.5 billion (1977 dollars) annual increase in industry profits. Although the financial performance of U.S. carriers has been poor, the implication is that it would have been significantly worse in the absence of deregulation.

Enthusiasm for deregulation has waned, but only somewhat, in face of the recent spate of mergers and acquisitions, along with evidence that entry into the industry is not as easy as had been presumed. Few economists would view these developments as testimony to the failure of deregulation. While competition may be imperfect, the attendant costs are not seen to approximate nearly the costs of what was a highly distortionary regime of price and entry regulation.

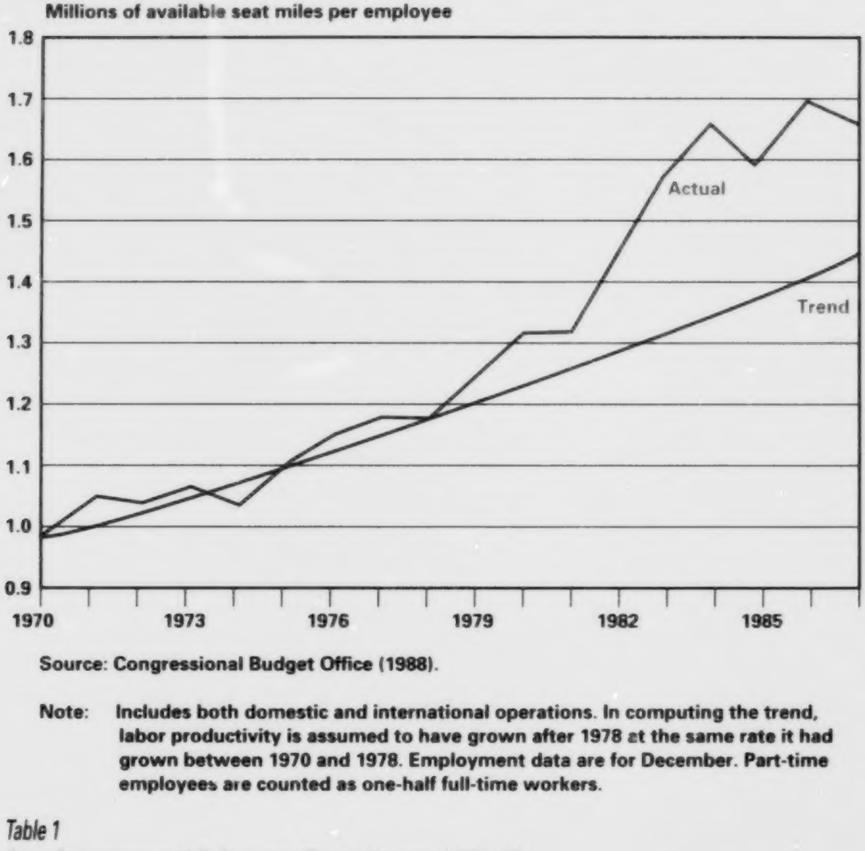
Recent developments, however, do underscore the need to understand the nature and effect of structural changes in the U.S. airline industry. High concentration and impediments to entry will undermine the benefits of deregulation if they reduce the pressure for carriers to improve efficiency or result in monopolistic pricing practices. There is, therefore, a continuing need for some form of monitoring of the conduct and performance of carriers. It is also important to attempt to understand the extent to which recent structural developments are the result of technological characteristics of air service as defined from certain features of the policy environment.

## 3. MAIN SOURCES OF GAIN FROM DEREGULATION

Several studies, in addition to Morrison and Winston (1986), have examined the impact of deregulation on airline efficiency. Bailey, Graham and Kaplan (1985), reported that competition from new low-cost entrants had led to a substantial increase in employee productivity among the formerly regulated carriers. More recent data gathered by the Congressional Budget Office (1988) substantiate the improvement; labour productivity, defined as seat-miles per full-time employee, increased at an annual average rate of 3.8% in the decade after 1978, compared with 2.3% between 1970 and 1978 (see Figure 1). At the same time, average load factor, another indicator of efficiency, increased from around 55% prior to deregulation to between 60% and 65% in recent years.[4] Caves et al. (1987) assessed the performance of U.S. carriers before and after deregulation against a control group of some 27 large carriers operating in countries where there was little or no deregulation. The evidence on foreign experience provided the authors with an alternative basis to consider what would have occurred in the absence of deregulation in the U.S.[5] They found that the total factor productivity of U.S. airlines, which accelerated after deregulation, would have instead fallen very substantially had the performance of U.S. carriers after 1975 changed similarly to that of foreign carriers.[6]

David Sawers (1987) examined the operating costs of U.S. carriers and attempted to distinguish cost reductions that are attributable to new aircraft from those that are due to managerial effort. It is the latter that is the test of airline efficiency and reflects the contribution of deregulation. His results, which are shown in Table 1, reinforce the finding that the efficiency gains achieved by U.S. carriers accelerated after deregulation.[7]

*Figure 1*
*LABOR PRODUCTIVITY*
*ACTUAL VS. TREND UNDER REGULATION*



**Source: Congressional Budget Office (1988).**

**Note: Includes both domestic and international operations. In computing the trend, labor productivity is assumed to have grown after 1978 at the same rate it had grown between 1970 and 1978. Employment data are for December. Part-time employees are counted as one-half full-time workers.**

*Table 1*
*COST REDUCTIONS IN U.S. DOMESTIC TRUNK AIRLINES, 1970–1984*

| | 1970 | 1978 | 1984 |
|---|---|---|---|
| Cost per available ton-mile (ATM) at 1978 input costs (cents) | 47.37 | 38.7 | 34.03 |
| | | percent | |
| Annual rate of reduction in costs (since 1970 or 1978) | — | 2.1 | 1.9 |
| Annual rate of reduction in costs attributable to new aircraft | — | 0.9 | 0.4 |
| Annual rate of reduction in costs attributable to management | — | 1.2 | 1.5 |
| Annual increase in capacity of fleet in ATMs | — | 3.2 | 1.6 |
| Annual increase in traffic in revenue passenger-miles (RPMs) | — | 6.9 | 1.4 |

**Source: Sawers (1987)**

Although questions can be raised about various aspects of these studies,[8] the cumulative evidence provides persuasive documentation of the favourable influence of deregulation on airline efficiency and costs. Airline performance improved significantly in the post-1978 environment when carriers enjoyed greater operating freedom and were subject to more intense competitive pressures. Airline costs declined partly because of the elimination of high rents enjoyed by airline workers under a regulatory regime that permitted high labour costs to be largely passed on to consumers. For example, Bailey, Graham and Kaplan (1985) found that, after deregulation, airlines were instituting two-tier wage structures (under which new employees are paid substantially less than employees already on the payroll), and introducing much more competitive work rules.[9] In addition, gains were achieved because airlines responded to the new opportunities and pressures under deregulation by taking advantage of available economies, and by relating their fares and quality of service more closely to costs and the nature of consumer preferences. These latter developments merit elaboration.

In general, the costs of air service per passenger are positively related to distance, and negatively related to the number of passengers. But while costs are lowered when larger aircraft are run at higher load factors, the resulting decline in flight frequency will inconvenience passengers. To maximize profits, carriers must balance cost savings from economies of scale and utilization against the revenue implications of the associated decline in quality of service.

Bailey, Graham and Kaplan (1985) have shown that the trade-offs are such that profit maximization will lead to the use of larger aircraft at higher load factors as distance and market density increase. In high-volume markets, the economies from more efficient use of resources exceed the decline in demand from reduced flight frequency. The same is true in longer-distance markets where consumer preferences are strongly influenced by the difficulty of substituting other modes of transport for air travel.

Under CAB regulation, carriers could not respond to these market realities. Part of the problem was a system of regulated prices which did not reflect costs. In short-haul markets, prices were set below costs, leading to an insufficient allocation of resources. By contrast, in long-haul markets, airlines engaged in non-price competition by increasing flight frequency and lowering load factors. The result was exactly the reverse of what we should expect from the economics of air service; load factors were lower on long-haul than on short-haul routes (see Appendix A).

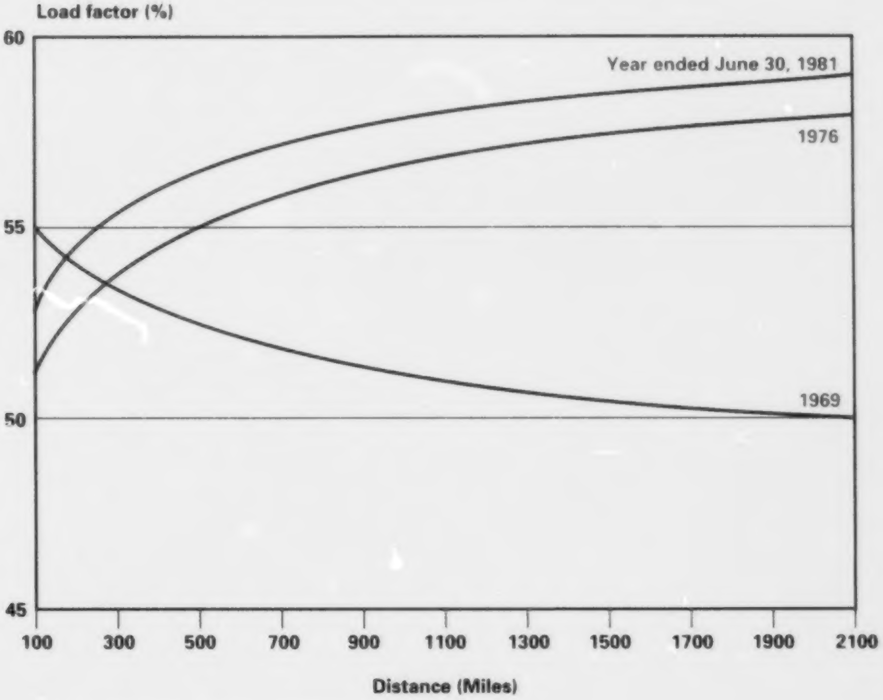
In a study predating deregulation, Douglas and Miller (1974) examined the costs of the service competition which took place under CAB regulation as a substitute for price competition. They found that the benefits to travellers from more frequent flights and improved in-flight amenities were more than offset by the attendant higher fares. The resulting welfare loss to travellers was estimated to be greater than $1 billion per year during the early 1970s.

Deregulation eliminated the misleading signals that were a product of CAB price regulation. Figure 2, which comes from Graham, Kaplan and Sibley (1983), shows that the perverse relationship between load factor and distance, which Douglas and Miller had identified for 1969, had been reversed with the relaxation of regulatory controls and the replacement of service with price competition.[10] Load factor increased at most distances because most consumers preferred a lower combination of price and service quality than was available under regulation. At the same time, however, deregulated carriers continued to offer a more expensive product to meet the special needs of those passengers who place a high value on service convenience.[11]

A second important consequence of deregulation was that it allowed carriers to alter their market coverage to exploit available economies more fully. This has resulted in the increased use of hub-and-spoke route structures, under which passengers from various cities are fed (by spoke routes) into a centralized airport (the hub), from which they take connecting flights to their destinations. Hub-and-spoke systems take advantage of economies of scope that exist because it is often less costly to produce airline outputs jointly than independently. Passengers from various origins who are going to a common destination are collected at a hub airport and put onto a single large aircraft, thereby producing a joint output. Underlying the advantages of joint production are the economies of larger aircraft and higher load factors that were discussed earlier. When these savings exceed the costs of rerouting traffic, economies of scope exist.

*Figure 2*

LOAD FACTORS AND DISTANCE[a]



**Source: Graham, Kaplan and Sibley (1983)**

**[a] For each year, curve is drawn for the mean values of passengers and number of airlines or Herfindahl Index.**

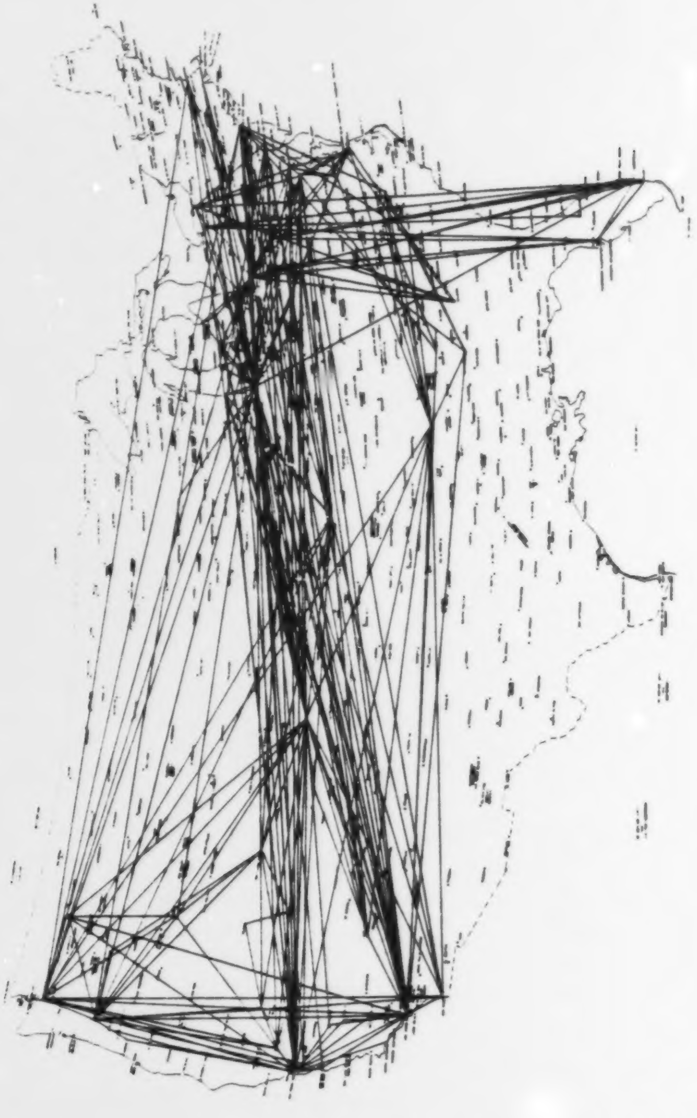
Hub-and-spoke systems were in operation before deregulation. The elimination of entry controls accelerated their use and allowed for a more rational structuring of hubs. The experience of United Airlines, which is illustrated in Figures 3A and 3B, typifies the dramatic changes in route patterns that occurred after deregulation.

The hubbing process requires carriers to synchronize flights to and from the various points in their system. Timing is important; to cross-connect passengers, carriers must move waves (or banks) of aircraft through connecting points at about the same time. A successful hubbing system also depends

Figure 3A

UNITED AIRLINES, INC.

UNDUPLICATED FLIGHT PATTERN, JULY 1979

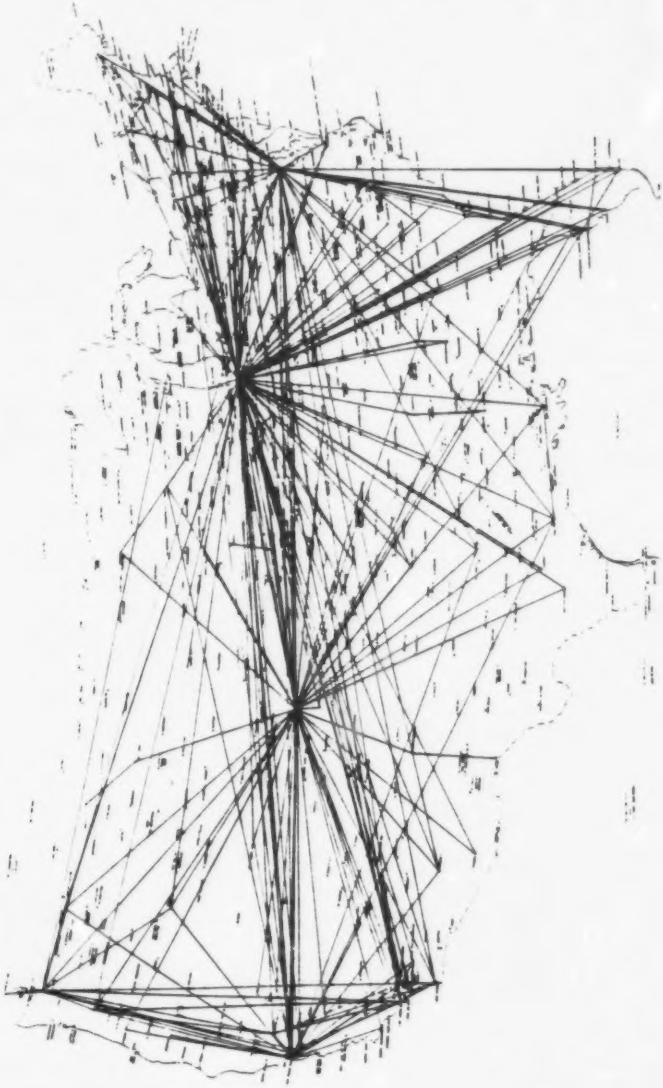


Source: Secretary's Task Force on Competition in the U.S. Domestic Airline Industry (1990d)

Figure 3B

UNITED AIRLINES, INC.

UNDUPLICATED FLIGHT PATTERN, MARCH 1989



**Source: Secretary's Task Force on Competition in the U.S. Domestic Airline Industry (1990d)**

on the establishment of an extensive network, involving cross-connections to a large number of points. An airline with several spokes emanating from its hub will be well placed to offer passengers service to their ultimate destination. The high "feed" from incoming flights will also help the airline achieve a high load factor on flights departing from its hub. While the hub-and-spoke system has increased efficiency, it has also had important implications for service quality and for airline concentration aspects (which we discuss in later sections).

## 4. AIRLINE FARES

It is generally agreed that deregulation brought fares more in line with resource costs of providing alternative services. Fares have risen on short-haul routes (where they were below costs under regulation) and fallen on long-haul routes. But the price disparities that have emerged do not simply reflect variations in cost; there has also been an intensification of price discrimination. The airlines' use of deep discount fares to attract marginal customers has been of great benefit to many discretionary travellers — although as Borenstein (1990) noted, this tends to be overlooked because the term "price discrimination" carries such negative connotations. Of more concern are those price disparities which reflect differences in the intensity of competition between different markets (for discussion see Section 8).

Several studies document the decline in average fares, adjusted for inflation, but results are sensitive to the time period selected, and the adjustments (if any) made to remove the effects of those factors unrelated to deregulation. Early assessments, such as the study by Bailey, Graham and Kaplan which focussed on the 1978–1982 period, were complicated by a number of important exogenous events: the 1981–1982 recession, the second oil shock and the U.S. flight controllers' strike. Assessments of the 1985–1987 period reflect the effect of the severe price wars which led to industry-wide losses. Real airline fares fell sharply, but the low rates were not sustainable.

Since 1987, real yield (that is, revenue per passenger-mile adjusted for inflation) has increased somewhat, but in 1988 it was still almost 22 percent below its level of a decade earlier. In itself, however, this does not substantiate the benefits of deregulation. Studies, such as that by the Secretary's Task Force on Competition in the U.S. Airline Industry (1990), which emphasize the decline in inflation-adjusted fares are open to the sorts of arguments illustrated in Table 2. This comes from a study by Paul Dempsey (1990) which attempted to document the failure of deregulation. What the table shows is that real yields were declining prior to deregulation and, indeed, when adjusted for changes in real fuel prices, real yields declined more rapidly in the decade before, rather than in the decade after, deregulation.

These results are significantly influenced by the choice of 1978 as the starting year of deregulation. The CAB had begun to allow discount fares and to relax substantially its price controls in early 1977. If, following Kahn (1988b), we choose 1976 as the critical dividing year, the growth rate differences indicated in the last column of Table 2 virtually disappear.

*Table 2*
*Yield and Fuel Price Indices*
*(1978=100)*

| | **Real yield (revenue per passenger mile)** | **Real fuel prices** | **Fuel adjusted real yields** |
|---|---|---|---|
| 1967 | 129.2 | 55.9 | 143.8 |
| 1968 | 123.5 | 54.1 | 138.0 |
| 1969 | 121.7 | 50.9 | 137.1 |
| 1970 | 117.3 | 47.0 | 133.4 |
| 1971 | 117.7 | 46.2 | 134.2 |
| 1972 | 114.3 | 46.3 | 130.3 |
| 1973 | 112.3 | 47.7 | 127.6 |
| 1974 | 116.2 | 82.1 | 120.9 |
| 1975 | 111.0 | 90.2 | 113.3 |
| 1976 | 110.1 | 92.5 | 111.9 |
| 1977 | 109.3 | 99.3 | 109.5 |
| 1978 | 100.0 | 100.0 | 100.0 |
| 1979 | 94.2 | 131.7 | 88.0 |
| 1980 | 104.9 | 180.1 | 90.0 |
| 1981 | 106.9 | 189.8 | 90.3 |
| 1982 | 95.9 | 168.6 | 84.0 |
| 1983 | 91.9 | 148.0 | 83.3 |
| 1984 | 91.8 | 135.7 | 84.9 |
| 1985 | 85.4 | 124.0 | 80.7 |
| 1986 | 77.5 | 140.7 | 79.1 |
| 1987 | 76.5 | 81.6 | 78.4 |
| 1988 | 78.4 | 74.9 | 81.4 |
| Growth rates: | | | |
| 1967–77 | -1.7 | 5.9 | -2.7 |
| 1978–88 | -2.4 | -2.8 | -2.0 |

**Source: Dempsey (1990)**

Moreover, fuel-adjusted real yields represent a crude and misleading attempt to adjust for the effects of inflation. A methodologically more acceptable approach was adopted by Morrison and Winston (1986, Chapter 3), who constructed a fare deflator by estimating the relationship between fares, input prices and output characteristics. The deflator allowed the authors to predict what 1983 (their post-deregulation benchmark) fares would have been if flight characteristics, fuel prices and wages were the same as in 1977 (their pre-deregulation reference year).

However, Morrison and Winston's methodology is, itself, open to criticism. The treatment of wages as an exogenous variable omits what some would claim to be a main impact of U.S. deregulation: the elimination of the rents that had accrued to airline employees under regulation. On the other hand, Morrison and Winston may have attributed too much of the decline in air fares to deregulation by failing to adjust for the cost reduction attributable to the introduction of new, more efficient aircraft. The latter has been an important factor underlying the long-term decline in real yields as indicated in Table 1. Sawers (1987) showed that the introduction of new aircraft did not significantly lower costs between 1978 and 1984, roughly the period examined by Morrison and Winston (see Table 1).

Despite the difficulty of estimating the precise impact of deregulation on prices, there is agreement that expectations created in earlier years by the disparity in prices between regulated interstate and unregulated intrastate carriers have, in general terms, been satisfied.[12] The gains in efficiency following deregulation have largely benefited consumers rather than investors; after deregulation, the rate of return on investment in the airline industry has remained less than half the average rate for all U.S. industries. In addition, consumers have benefited from an elimination of the biases toward higher fares that were incorporated in the CAB pricing formula. Updated calculations of the Standard Industry Fare Level (SIFL) formula undertaken by the Department of Transportation indicate that, as of the third quarter of 1989, CAB regulation (applied to the cost levels of deregulated carriers) would have resulted in prices, on average, 8 percent higher.[13]

## 5. SERVICE QUALITY

Based on the evidence that price controls caused wasteful service competition, it was expected that deregulation would lower the average quality of service — albeit providing an overall price-service package that was more reflective of consumer preferences. To some extent this has occurred. Responding to market demands, airlines have traded off, for example, wide seating and various in-flight amenities, for lower prices. There has also been a strong growth in the discount fare portion of the market (from 48 percent in 1979 to 91 percent in 1988) and, because of their various restrictions, discount fares represent a somewhat lower quality of service than coach fares. But the overall impact of deregulation on service quality is quite different from expectations, in large part because of the consequences of the hub-and-spoke system.

The hubbing process itself involves an additional connection, and thus increases travel time for some passengers. This is more than offset, however, by the benefits of hub-and-spoke operations: more on-line service (rather than interline service in which passengers must switch both planes and carriers to complete their flight) and more frequent flights to most destinations. The latter has been a particularly important development. The airlines have greatly improved the service available on low-density routes by providing more frequent flights using smaller aircraft between non-hubs and hubs. According to the Secretary's Task Force (1990b), most small points now receive three or more flights a day to a connecting hub that provides access to most large cities throughout the country. Under the previous linear system, small cities received only one or two flights to particular destinations, with these generally including one or more intermediate stops.[14]

Morrison and Winston found that business travellers, who place a high value on finding flights that correspond to their desired departure time, were the main beneficiaries of the increase in flight frequency. Indeed, this was a main source of the almost $6 billion annual gain in consumer welfare identified in their study.

Morrison and Winston's estimates did not capture what many travellers would consider to be two of the most important and disturbing recent developments: the greatly increased congestion and delay at major U.S.

airports. These have been caused by the increased traffic concentration at hubs, but more importantly, by the recent growth in air travel, which is due to deregulation as well as other factors such as the buoyant U.S. economy. Most economists, however, would agree with Kahn (1988a, p. 321) that airport congestion is not a necessary and inherent cost of deregulation; rather, it is due to the failure of government authorities "to expand airport and air traffic control capacity and . . . to price those scarce facilities at their marginal opportunity costs." In a more recent Brookings study, Morrison and Winston (1989) estimated the potential net benefits from combining more economically appropriate landing fees with optimal investments in runway capacity to be at least $11.0 billion annually.

## 6. SERVICE TO SMALL COMMUNITIES

The fear that carriers would take advantage of the freedom of entry or exit under deregulation to abandon service on low-density routes has turned out to be unfounded. The findings of the Secretary's Task Force (discussed above) support an earlier General Accounting Office (GAO) study (1985) which found that between October 1977 and October 1984, weekly departures increased by 31.3 percent at small hubs and by 20 percent at non-hubs. Moreover, because of the nature of the hub-and-spoke system, each of these departures offered connections to destinations throughout the country — a major improvement over the access available under the previous system.

In addition to the benefits from adoption of the hub-and-spoke system and the replacement of jets with smaller aircraft that could economically serve these thinner markets, air service to small communities was protected through specific provisions in the *Airline Deregulation Act*. Section 419 of the Act, dubbed the Essential Air Service Program (EAP), guaranteed the provision of service to points that were certified and thereby protected under earlier legislation, as well as to some points that had been decertified over the previous decade. As of February 1, 1986, the CAB, which administers the program, was providing $24.1 million in annual subsidies to preserve service to 105 points. The EAP was a significant improvement over its predecessor, which had inadvertently encouraged the use of inappropriate aircraft and the provision of a lower quality of service.[15] It was also less costly: Meyer and Oster (1984) estimated that the EAP provided savings of around 30 percent, compared to the per passenger subsidy provided under the previous program.

The EAP has not prevented carriers from terminating service to uncertified points. The GAO (1985) reported that 114 communities lost all scheduled air service between October 1978 and October 1984. This was, however, a continuation of a trend that had begun well before deregulation. Morrison and Winston (1986) attempted to isolate the impact of deregulation from other factors, for example, GDP, fuel prices and interest rates, that influence the number of points in the scheduled air service network. Their finding, that economic conditions rather than deregulation, caused the observed loss in service to small communities, reinforces the conclusion that deregulation has, on balance, had a highly favourable impact on passengers in low-density markets.

## 7. AIR SAFETY

In a perfect market, carriers will treat safety in the same fashion as they treat other aspects of service quality and will make an optimal investment reflecting travellers' willingness to pay for increased safety precautions. Morrison and Winston (1989) showed that travellers attach significant importance to a carrier's safety record. But while the market encourages carriers to operate safely, the incentive structure will not be optimal because of the inadequacy of the information available to consumers. The costs of this market failure could conceivably increase under deregulation where carriers are under strong pressure to gain a competitive advantage.

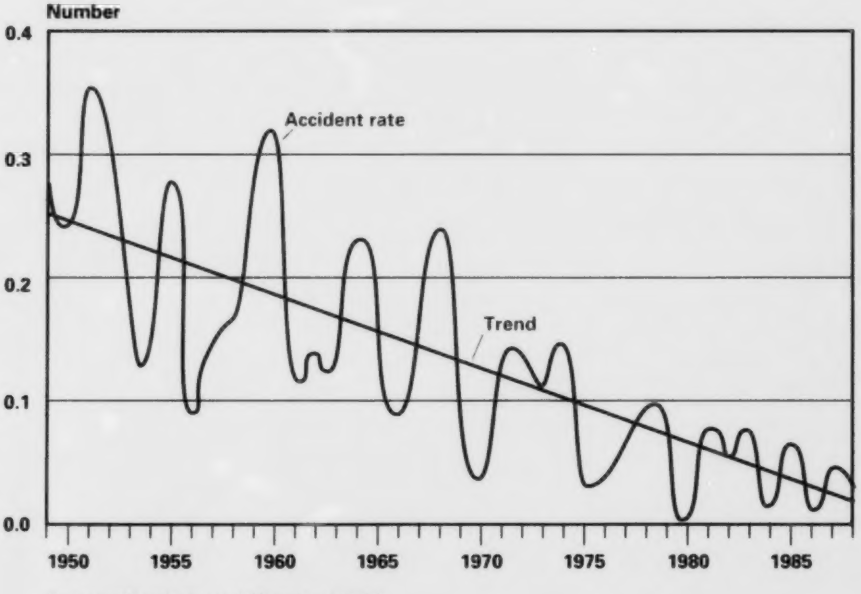
Empirically, it is very difficult to determine if this has been the case. Airline accident rates — that is, fatal accidents per 100,000 departures — have declined secularly in the U.S. due to various technological developments and training improvements (see Figure 4). To determine if the decline in the recent period would have been greater in the absence of deregulation, it is necessary to control for all other possible influences (besides regulation) on accidents, some of which are very difficult to identify and measure.

Studies that have examined the causes of airline accidents do not suggest that deregulation has been a significant factor. Oster and Zorn (1987), for example, found that accident rates based on equipment failure were lower in the post-deregulation period, indicating there has been no slackening in maintenance practices. They also found that the growth of the hub-and-spoke system has not led to an increase in accidents related to air traffic control. Kanafani and Keeler (1987) found that concerns relating to the safety practices of new entrants were unjustified; the overall safety record of new entrants was no worse than that of established carriers.

Critics of deregulation maintain that accident data do not reflect the true situation. Dempsey (1990) pointed to a number of potentially troubling indicators including the increase in the age of the fleet; the decline in maintenance expenses as a proportion of total operating expenses; and the decrease in the average level of experience of pilots. He referred to a survey of airline pilots in which 97 percent were reported to concur with the view that deregulation has adversely affected safety.

*Figure 4*

*FATAL ACCIDENTS PER 100,000 DEPARTURES, U.S. CERTIFICATED AIR CARRIERS 1949–1988*



**Source: Morrison and Winston (1989)**

While most economists are sympathetic to the need for further research and improved understanding in this area, no economist would regard safety concerns as an indictment of price and entry deregulation. The *Airline Deregulation Act of 1978* did not affect the authority of the Federal Aviation Administration (FAA) over airline safety. To the extent the evidence on airline safety raises questions, these pertain not to the merits of deregulation, but to the adequacy of administration and enforcement by the FAA. Even researchers, such as Morrison and Winston (1989), who believe that deregulation has not reduced long-run safety, have suggested that there is considerable scope to improve institutional arrangements so that the government is better able to manage and promote air safety.

## 8. INDUSTRY STRUCTURE AND COMPETITION

The long-run consequences of deregulation depend crucially on the existence of effective competition. It is competition which generates the pressure to increase efficiency and to pass the resulting gains on to consumers. The relevant issues in this area can usefully be discussed by addressing three basic questions:

- What has occurred?
- What are the implications of the structural changes that have occurred?
- To what extent do these changes reflect underlying production technology, as opposed to the influence of government policy?

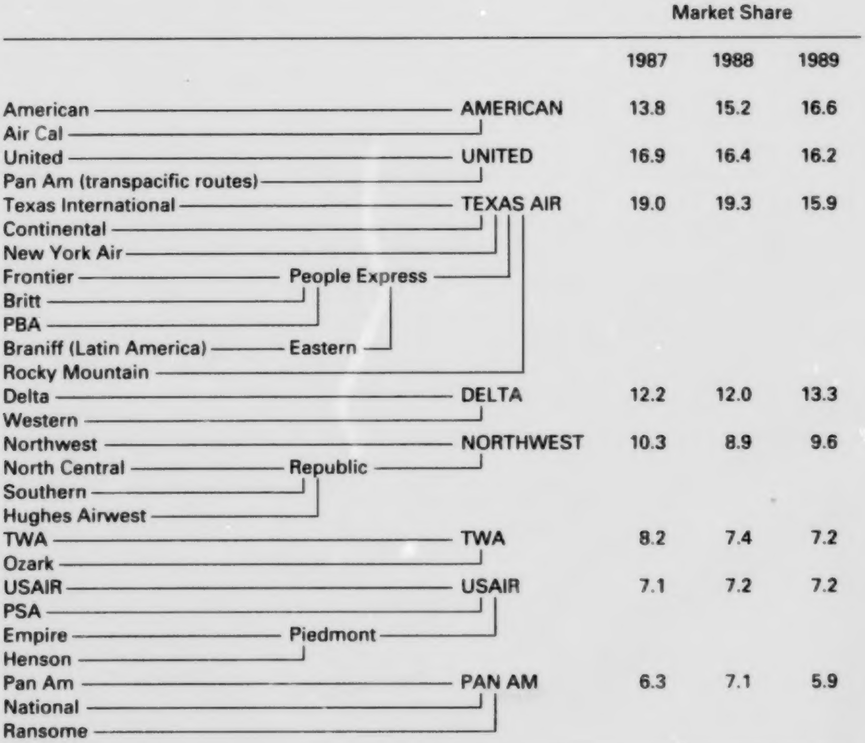
### WHAT HAS OCCURRED?

One perspective on what has occurred comes from an examination of recent mergers and acquisitions which have greatly increased the degree of industry concentration. Between 1978 to 1984, the industry expanded but then went through a period of consolidation (see Figure 5) that, by 1989, resulted in 92 percent of the industry's revenue passenger-miles being concentrated in the eight largest airlines.

Organization and route restructuring has also given rise to increased concentration at large- and medium-sized hub airports.[16] Figure 6 shows the increase in concentration at many of the most important U.S. airports between 1979 and 1988. At six large hubs, a single carrier accounts for 75 percent or more of all enplanements. This concentration is partly a logical consequence of the pressures within the hub-and-spoke system for carriers to establish a high degree of control over traffic to and from their connecting hubs.

*Figure 5*

**MAJOR AIR CARRIER MERGERS, ACQUISITIONS, PURCHASES AND CONSOLIDATIONS SINCE PROMULGATION OF THE AIRLINE DEREGULATION ACT OF 1978**

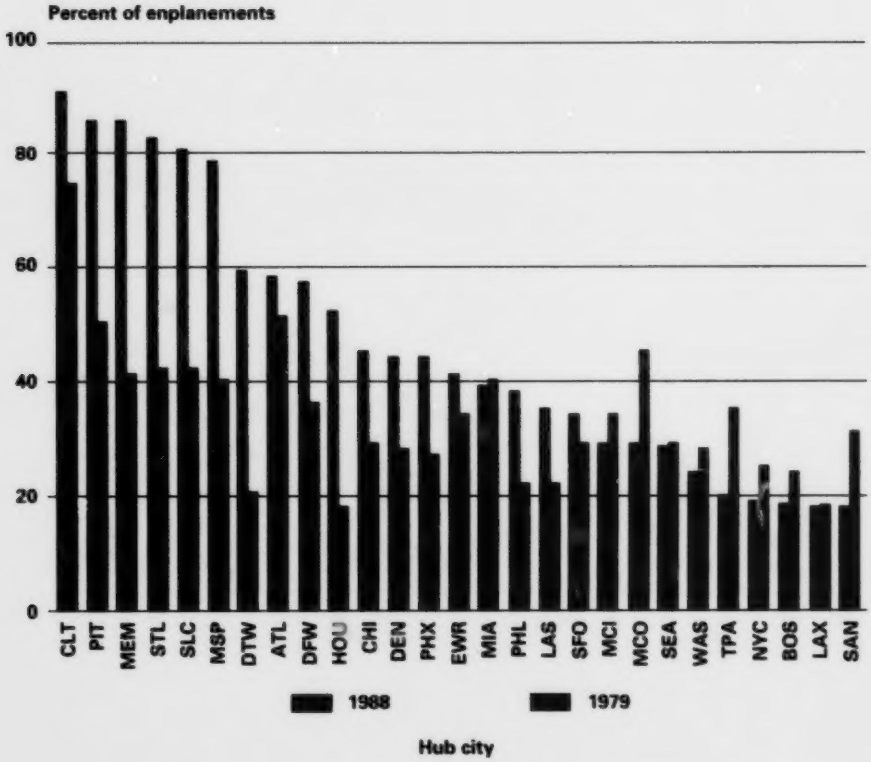

Market Share
1987 1988 1989
American — AMERICAN 13.8 15.2 16.6
Air Cal
United — UNITED 16.9 16.4 16.2
Pan Am (transpacific routes)
Texas International — TEXAS AIR 19.0 19.3 15.9
Continental
New York Air
Frontier — People Express
Britt
PBA
Braniff (Latin America) — Eastern
Rocky Mountain
Delta — DELTA 12.2 12.0 13.3
Western
Northwest — NORTHWEST 10.3 8.9 9.6
North Central — Republic
Southern
Hughes Airwest
TWA — TWA 8.2 7.4 7.2
Ozark
USAIR — USAIR 7.1 7.2 7.2
PSA
Empire — Piedmont
Henson
Pan Am — PAN AM 6.3 7.1 5.9
National
Ransome

**Source:** **Dempsey (1990)**

**Note:** **Since 1989, the industry has become more concentrated. Among the more important recent developments: Braniff and Eastern have closed down, and Pan Am and Continental are operating under the protection of U.S. bankruptcy laws.**

*Figure 6*

*DOMINANT CARRIER SHARE AT LARGE HUBS*
*BASED ON ENPLANEMENTS AND 1989 FAA HUB CLASSIFICATIONS*



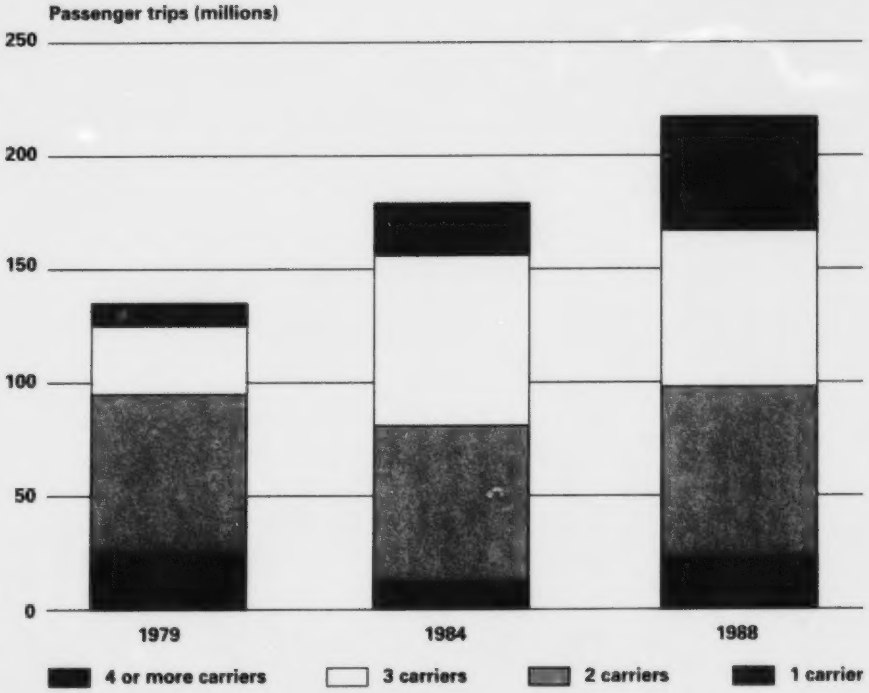
**Source: Secretary's Task Force on Competition in the U.S. Domestic Airline Industry (1990b)**

A different and more encouraging perspective emerges from an examination of individual routes which are generally considered to be more relevant indicators of what is happening. Here, competition has increased. The situation, as portrayed in Figure 7 and described by the Secretary's Task Force (1990a, p. 4) is as follows:

> Whether measured by the volume of passenger trips (as shown), revenue passenger miles, or number of travel markets, competition in city-pair markets grew between 1979 and 1988. In 1988, more than 55 percent of the passengers travelled in city-pair markets served by three or more air carriers, up from 28 percent in 1979.

*Figure 7*

PASSENGER TRIPS BY COMPETITIVE STATUS



**Source: Secretary's Task Force on Competition in the U.S. Domestic Airline Industry (1990a)**

Of the top 1,000 passenger markets in the U.S., 72 percent were less concentrated in 1988 than in 1979. This increase in route competition can be reconciled with the increased degree of industry concentration at the national level by the fact that the major carriers greatly extended their networks in the decade after deregulation.

In other words, while there are now fewer carriers, each is a participant in a much larger number of markets. The ten major carriers and their regional partners served 1,361 points in 1988, as compared to only 531 points in 1979.[17]

The main exception to this positive trend in the structure of city-pair markets is the reduced degree of competition on short-haul trips — (under 1,000 miles) — to or from a concentrated hub. Non-hubbing carriers have stopped competing in these markets, so competition is essentially limited to carriers that hub at either end point. But it is important to distinguish between "local" traffic moving between a spoke city and a hub, and "flow" traffic for which the hub is likely to represent only one of a number of possible connecting points to the ultimate destination.[18] Concentration is an issue only with respect to local traffic, while most movement from smaller centres to hubs is with respect to flow traffic.

## WHAT ARE THE IMPLICATIONS OF THESE STRUCTURAL CHANGES?

Several studies have investigated the relationship between market structure and airline fares. The results indicate that fares fall as the number of competitors on a route increase, and that an additional carrier has greater impact on a market where there are fewer existing competitors. For example, Morrison and Winston (1989) found that losing a competitor on a route raised fares by 2 to 32 percent, with the high end of the range represented by situations in which there was only one carrier left serving a market. At the mean distance in their sample of 112 routes, the round-trip fare increased by $89 when the number of competitors went from two to one; the increase was only $6 when two or more carriers remained after one carrier had exited. These results are similar to the findings of Hurdle et al. (1987).

The effect of market concentration on fares tends to be greater where entry barriers exist. One potential barrier is the existence of a hub at the point of origin or destination on a route. Levine (1987, p. 412) elaborated on this:

> At a "strong" hub — one where one or two airlines have large connecting complexes which account for a large proportion of departures — any new entry that does occur ordinarily seems to be limited to service to and from other airlines' strong hubs. The new entrants do not appear to compete on the hubbing airline's spoke segments to other non-hub cities. Infrequently, an attempt will be made to establish a competing hub structure at another airline's strong hub or a struggle will develop among several airlines attempting to establish a hub where none existed before. But the contests that occur are usually treated by contestants and observers alike as battles for the survival of only one or two carriers, who are expected to earn rents at the hub once the smoke clears and the dead and wounded are carted away.

Hurdle et al. (1989), Morrison and Winston (1989) and Borenstein (1989) all found that the effect of a merger which reduces the number of airlines on a route is more serious when the origin or destination is a hub.[19] In Morrison and Winston's study, loss of a competitor increased fares as high as 55 percent when hub effects were taken into account. Borenstein (1989) found that a carrier that had a dominant position at an airport charged higher prices than it did elsewhere, although per passenger costs tended to be lower. He also observed that the dominant carriers were able to charge higher prices than their competitors; in other words there was no "umbrella effect" from which carriers with smaller operations may benefit.

The evidence on pricing indicates that U.S. airline markets are not perfectly contestable.[20] Under the contestability hypothesis, the threat of entry should suffice to keep fares at competitive levels; high levels of market concentration should not result in higher prices. Contestability depends on ease of entry and exit, but there are a number of impediments to entry into U.S. airline markets. These include carrier reputation (including its safety record), hub-and-spoke route systems, computer reservation systems, frequent flyer programs, travel agent commission override programs, and the limited availability of airport slots and gates. Many of these factors are mutually reinforcing. For example, at a major hub, the airline that controls the converging network and can provide single-line service to a wide range of destinations, has a strong advantage.[21] This is reinforced by frequent flyer programs, which create strong brand loyalty among passengers, and by travel agent commission override programs, which increase the commissions payable to travel agents who sell a certain proportion of their tickets on a particular airline.

While airline markets do not satisfy the conditions for perfect contestability, this does not mean that the competitive threat posed by potential entrants is inconsequential. The most detailed examination of this issue, by Hurdle et al. (1989), indicates that potential (as distinct from actual) competition is a significant factor in *some* markets. The relevant city pairs are short-distance routes (that is, under 800 miles), where there are no barriers to entry due to low-density traffic or because the city pair is primarily providing feed to a connecting hub which is part of a well developed hub-and-spoke system. Indeed, markets in which potential entry is deterred because of economies of scale (arising from low-density traffic)[22] or economies of scope (associated with a hub-and-spoke system) account for a small proportion of domestic passenger traffic. The Secretary's Task Force (1990) corroborated the results of other studies with respect to the higher fares on short-haul trips (defined, here, as under 1,000 miles) originating or terminating at the nation's most concentrated hubs,[23] but it found that the relevant markets represented just over 4 percent of domestic revenue passenger-miles.

Still, the number of passengers affected by the combination of high concentration and high barriers to entry is not insignificant. And there is concern that continuing airline consolidation and route restructuring could result in substantial growth in the number of city-pair markets where competition is weak or absent. These concerns must be set against the favourable general finding that competition on most city-pair markets has increased since deregulation.

In addition, some consideration should be given to the threat that the small number of major U.S. airlines will engage in collusive behaviour. Collusion on a nation-wide basis could only be successful if there are substantial barriers to new entry in all city-pair markets, or if entry is successful only on a large scale.[24] The U.S. government is currently investigating possible collusion among the airlines through the use of the computer reservation system. Anecdotal evidence suggests that airlines use the computer system to signal intended price increases which can then be abandoned if other carriers do not go along.

## STRUCTURAL CHANGE AND GOVERNMENT POLICY

There is widespread agreement that the benefits of U.S. airline deregulation have been reduced as a result of inadequacies in various other (that is, non-regulatory) aspects of public policy. It is very difficult, however, to determine to what extent more appropriate policies and better management of the transition to deregulation could have improved the competitive environment.

Contrary to earlier expectations, size does confer an advantage on carriers. While the strength of the major airlines partly reflects sunk costs and long-term contracts which provide them with a high degree of control over strategic airport facilities, it is also a result of their ability to operate an elaborate network and maintain high flight frequencies. The latter aspects can be partly attributed to certain benefits of scale.[25] Larger firms are better able to operate an efficient hub-and-spoke network. They can more easily finance the lumpy investment associated with the use of price-optimizing technologies. They are in a better position to induce brand loyalty through the use of frequent flyer programs, and to establish incentive schemes to influence travel agent recommendations. And only larger carriers are able to take advantage of the benefits of owning computer reservation systems. Bailey and Williams (1988) have noted that American's Sabre system, and United's Apollo dominate the travel agencies in the hubs where these carriers operate.[26] Despite efforts to eliminate the "display bias" in the way flights are listed, travel agents still tend to favour those carriers who own the reservation system.[27]

The public policy problem arises from the fact that these factors are not simply sources of market power; they also convey some real economic benefits. Earlier, we discussed the economies of scope associated with a hub-and-spoke routing system. Levine (1987) also credited the system with providing savings in consumer search costs. In particular, large network operations reduce the costs of acquiring reputation and service information "which is subtle and difficult for individuals to accumulate and assimilate." Bailey and Williams (1988, p. 189) suggested that the ownership of a computer reservation system can also be a source of efficiency gains: "Carriers with these systems can fill more seats by more efficient matching of customer preferences with available discount fares, and they can more effectively schedule capacity, resulting in higher load factors." It is similarly argued that frequent flyer programs enhance airline efficiency. By appropriately funnelling frequent flyer awards, the airlines are able to fill seats that would otherwise be empty.

One area where the need for reform is apparent is airport policy. Governments can much more efficiently allocate scarce facilities at the major commercial airports. Currently capacity at the busiest airports is rationed through the use of take-off and landing rights or "slots."[28] Although slots can be purchased, it may be very difficult for a new carrier to acquire the necessary rights to enter a slot-constrained airport. Entry is also complicated by the shortage of ground facilities such as gates and check-in areas at large hub airports. Part of the solution, as Morrison and Winston (1989), Kahn (1988a) and others have pointed out, is to replace current landing fees with those that reflect marginal opportunity costs and thus fully take account of an aircraft's contribution to congestion during peak periods.

Airport authorities could also attempt to buy back under-used gates and to extricate themselves from arrangements with carriers which limit their ability to expand groundside facilities.[29]

As well, substantial benefits may be realized through an efficient expansion in airport capacity. This would require local authorities to increase capacity up to the point where the extra costs are equivalent to the benefits in terms of reduced congestion and delay. However, as the Congressional Budget Office (1988) has noted, many large airports do not have the space for new runways, and noise and land-use concerns are a major obstacle to airport expansion.

Airline marketing practices have been the subject of a number of inquiries. Frequent flyer programs, computer reservation systems and travel agent override commission programs impede competition. They can also cause serious principal-agent problems; frequent flyer programs create a possible divergence in interests between business travellers and their employers, while commission override programs, which affect the self-interest of travel agents, may adversely affect travel agents' clients. Since these marketing arrangements appear, at the same time, to have some beneficial consequences, the appropriate policy response is far from certain. Recently, ownership of three of the five computer reservation systems in the industry has become more diversified. This lessens the concern that computer systems will be used to thwart competition.

To those who believe that the high level of airline concentration reflects the failure of government policy, one of the most significant aspects of this failure was the Department of Transportation's inability to control the merger wave that occurred between 1984 and 1987. The Congressional Budget Office (1988) found that there is basis to criticize the decisions of the Department of Transportation (which mistakenly assumed airline markets were perfectly contestable), but these decisions "did not play a large role in the consolidation of the industry." On the other hand, Morrison and Winston analyzed six mergers approved over 1986–1987, and found that all resulted in decreased competition and significantly higher fares. It is only when they took into account the non-price benefits of mergers, and particularly the effect of mergers in raising the value of travellers' frequent flyer benefits, that some of the mergers seemed, on balance, to be positive. As Morrison and Winston themselves acknowledged, however, the evaluation of frequent flyer benefits is problematic. The authors interpret their results not so much as a criticism of previous merger decisions, but as an indication of the limitations of merger policy in terms of its ability to take account of the long-run opportunity cost of network consolidation.

## CONCLUSION

There is general agreement that airline deregulation in the U.S. has been a success. The changes in route patterns and organizational structures which have occurred in response to market forces have resulted in major improvements in efficiency. Wasteful service competition has been eliminated, and the price-quality offerings of U.S. carriers now more closely reflect costs and traveller preferences. Some questionable distributive aspects of the previous regime have also been eliminated; in particular, airline employees no longer enjoy rents in the form of high wages and inefficient work rules. Deregulation has not reduced the service available to small communities, nor has it disrupted the long-term trend toward improved airline safety.

These positive developments have been only partly offset by some unfavourable structural trends. While there has been an increase in the number of competitors in most city-pair markets since deregulation, the airline industry as a whole has become quite concentrated. Moreover, the expectation, that deregulated airline markets would be perfectly contestable and that the threat of entry would thereby limit the opportunity for the exercise of market power, has proven incorrect. Airline fares are higher where routes are highly concentrated and/or where one or two carriers are in a dominant position at an airport. Along with concerns pertaining to the power of carriers in particular markets, the high degree of industrial concentration and the current use of computer reservation systems are seen, by some, to pose a threat of collusion at a national level.

The competitive advantage of large carriers is partly a natural consequence of their efforts to develop an efficient network and to build a reputation as reliable providers of air service. It is also attributable to airline marketing practices involving frequent flyer programs, computer reservation systems and travel agent commission override programs. And it is a result of entry barriers arising from the lack of slots and ground facilities at some airports. To some extent, these reflect certain inadequacies in U.S. policy. As Elizabeth

Bailey, an ex-member of the CAB, has herself acknowledged (1989, p. 113), "the Civil Aeronautics Board [failed] to treat civil aviation policy as a complete system of interrelated elements. [It] did a partial equilibrium analysis, deregulating the rate-and-route authority that [it] had within the CAB, without fully addressing such policy issues as airport capacity and air traffic control."

At the same time, however, some of these issues pose very difficult trade-offs between increased efficiency and reduced competition. For example, a merger may eliminate competition on a route, but traffic density may be such that only one carrier can efficiently serve the market. An acquisition may substantially strengthen the position of a carrier at a given hub, but the threat from this increase in concentration must be balanced against the real efficiency gains from a better developed network which generates increased feed to and from all points. Moreover, the threat to market forces from such developments may be quite subtle. The anti-competitive effect of a merger, for example, may come from the *potential, long-term* impediment to entry from network consolidation.

Similarly, the incremental contribution of particular marketing practices to the market power of large carriers will often be very difficult to isolate. At issue is not simply the administration of competition policy, but the more fundamental question as to whether competition policy can provide a sufficient safeguard against the exercise of market power. While the evidence argues strongly against the reregulation of the airline industry, it does not allow one to entirely dismiss the possibility that some protection may be required for passengers in particular airline markets.

# APPENDIX A

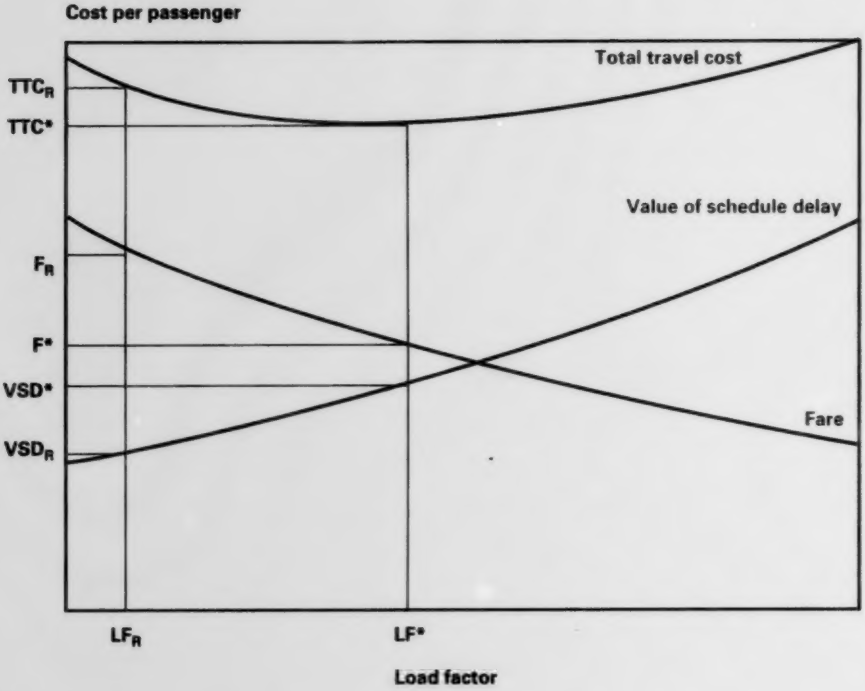
## THE OPTIMAL LOAD FACTOR

Following Morrison (1989), the effect of regulation on load factor and quality of air service can be illustrated using Figure A-1. The line labelled "Fare" represents the combinations of fares and load factors that result in normal profits. At higher load factors, lower fares are consistent with normal profits. The line labelled "Value of Schedule Delay" represents the loss to passengers arising from the gap between their actual and their desired departure time. This slopes upward because higher load factors are associated with fewer flights and this, in turn, is likely to result in increased passenger delay. "Total travel cost" represents the cost to passengers, taking account of the impact of increasing load factor on both fares and passenger delay.

In a competitive market, carriers will be under pressure to minimize the total cost of travel, consistent with their own need to earn normal profits. This will result in the establishment of fare F* at load factor LF*. Under CAB regulation, fares were set at a level such as $F_R$, and carriers competed by increasing flight frequency until all excess profits were eliminated. In the diagram this occurs when the load factor has been reduced to $LF_R$. Total cost to the passenger, $TTC_R$, is above the minimal point on the travel cost curve, and the traveller is presented with a price-quality package that is much less desirable than that which would result under competition.

This distortion was particularly marked in long-distance markets. In the figure, the fare curve for a long-distance flight would be above that for a short-haul flight, and the "Total Travel Cost" curve would move up and to the right. As a result, minimum total travel cost occurs at a higher load factor in long-distance markets. But, because CAB fares were set at a level that initially provided substantial excess profits in long-distance markets, the ensuing competition led to abnormally high flight frequency and extraordinarily low load factors on these routes. Hence, contrary to the optimal relationship, CAB regulation resulted in load factors that declined with distance.

*Figure A-1*
*OPTIMAL LOAD FACTOR DETERMINATION*



**Source: Morrison (1989)**

The figure can also be extended to take account of the differing preferences of business and vacation travellers. Since business travellers tend to attach a higher cost to schedule delay, the minimum point on their "Total Travel Cost Curve" will be to the left of that for vacation travellers. Business travellers would be best served through a lower-than-average load factor, and a correspondingly higher fare. The reverse is required to meet the needs of vacation travellers. This distinction was not recognized under CAB regulation, where fares were based mainly on distance. In consequence, regulated fares were above the optimal level on vacation routes, as well as on long-distance routes.

## ENDNOTES

1. Federal regulation did not apply to *intra-state* carriers. Evidence of the superior performance of unregulated intra-state carriers in California and Texas influenced the public policy debate leading up to deregulation.

2. The liberalization process accelerated after Alfred Kahn became Chairman of the CAB in 1977. "Supersaver" fares were introduced in the spring of 1977. In the fall of 1978 a "zone of reasonableness" was established which allowed carriers to set fares as much as 10 percent above or 50 percent below a CAB standard fare. In May 1980, the upper boundary of this zone was extended and the lower boundary entirely removed.

3. This Essential Air Service Program is still in operation although it was initially scheduled to expire in 1988.

4. Average load factor had dropped below 50 percent in the early 1970s as the opportunity for higher profits resulting from the development of increasingly efficient jet aircraft led to increased service competition; flight frequency increased and load factor declined until excess profits were eliminated. After 1972, the CAB tried to take account of this effect in setting rates which resulted in some improvement in the load factors of the major U.S. airlines just before deregulation.

5. In most studies, the counterfactual case on how the industry would perform were it still regulated is developed from an extrapolation of trends observed in the period before deregulation.

6. For U.S. carriers, the growth of total factor productivity accelerated from a 2.9% average rate over the period 1970 to 1975 to a 3.1% rate over the period 1975 to 1983. Had the performance of U.S. carriers changed in the same way as non-U.S. carriers, total factor productivity would have grown by only 1.8% per year over 1975 to 1983. The results from accumulating these differences over the eight years suggest that, in the absence of deregulation, 1983 airline costs would have been 10% (or $4 billion) higher. Caves et al. dated deregulation from the relaxation of CAB price control in the mid-1970s. However, they found that using 1978, the year the *Airline Deregulation Act* was passed, as their transitional year did not change their general conclusions regarding the positive effect of deregulation on the growth of total factor productivity.

7. Sawers pointed out that this improvement was all the more impressive in the context of the much slower growth in air traffic (due in part to the oil shock and recession) after 1978. In this environment, as opposed to that prevailing between 1970 and 1978, efficiency gains were more difficult to achieve.

8. For example, it has been argued that the industry was not in equilibrium during the period observed by some of the studies. With the exception of Morrison and Winston, the studies have not attempted to adjust for differences in the mix and quality of output before and after deregulation. The studies' assumptions about what would have occurred in the absence of deregulation are also open to challenge.

9. New entrants created strong pressures for incumbents to achieve less restrictive work rules. Graham, Kaplan and Sibley cited a number of pertinent examples. Pilots at Southwest, a former intra-state carrier, averaged more than 50 percent more flying hours per month than pilots of the formerly regulated carriers. Southwest's cost of operating a Boeing-737 was initially much less than that of United, a formerly regulated carrier, in large part because United's labour contract required it to use a three-person cockpit crew to fly a two-person

aircraft. United subsequently renegotiated its labour contract so it could use a two-person crew. In addition, Southwest and other new entrants had more flexibility in allocating labour; for example, baggage handlers could be called up to load in-flight meals.

10. The load factor curves in Figure 2 were derived from equations estimating the relationship between load factor, distance, concentration and traffic volume. While the 1976 results predate deregulation, the CAB had, by this time, recognized the effect of its rate controls on load factor, and it had adjusted its pricing formula to reduce airlines' incentives to engage in non-price competition.

11. Airlines have met the need of time-sensitive passengers by setting aside a number of seats on each flight for full-fare passengers. They have also introduced peak-load pricing which reserves seats on peak flights for those who place a high cost on delay time.

12. A number of studies have highlighted the lower fares charged by unregulated intra-state carriers. For example, Jordan (1970) found that, in California, the fare level of intra-state carriers was 32 to 47 percent lower than the comparable rates charged by CAB regulated trunk carriers. From a model based on the costs of California carriers, Keeler (1972) estimated that the disparity between regulated and unregulated fares was between 20 and 95 percent, with the gap increasing with distance.

13. This estimate does not take account of the contribution of deregulation to reducing carrier operating costs because the SIFL formula is partly based on costs. Fares were set by a fixed charge plus a per-mile addition, calculated so as to allow the industry to earn a 12 percent rate of return on its base, assuming a 55 percent load factor.

14. The ability of a hub-and-spoke system to provide increased service to small centres can be seen by looking at a simple network of five cities. As Morrison (1989) showed, using a linear system, 20 non-stop flights per day are required to provide one non-stop flight between each city. With a hub-and-spoke arrangement, those 20 flights will provide two connecting flights per day between each of the cities.

15. The previous subsidy program was under the authority of section 406(a) of the *Civil Aeronautics Act of 1938*. The individual carrier subsidies introduced by the CAB in 1954 were replaced by a "subsidy class rate" system in 1961 which remained in effect until the termination of the 406 program in 1983. Meyer and Oster (1984) noted that the "class rate" formula was generous in identifying the portion of the carrier's investment base relating to subsidized operations. (This portion is the basis for calculating the amount of subsidies required to provide a reasonable return.) The effect was to encourage carriers to invest in jet aircraft that were more suitable to long-haul, high-density markets and, hence, to hasten the abandonment of small communities by local service carriers. Also, since subsidy rates were based on the volume, and not the quality, of service, there was an incentive for carriers to provide a lower quality of service to small communities; carriers could maximize their revenue by flying subsidized routes during off-peak periods (when they could earn less revenue on their nonsubsidized routes), and by flying a multi-stop route among subsidy-eligible points.

16. The Federal Aviation Administration defines large hubs as those that account for 1% or more of all domestic enplaned passengers. Medium hubs account for 0.25 to 0.999%; small hubs, 0.05 to 0.249%; and non-hubs, less than 0.05%.

17. These data come from the Secretary's Task Force on Competition in the U.S. Airline Industry, (1990d, I).

18. The following example, from the Secretary's Task Force (1990b, p. 16) illustrates this point:

> A small hub like Akron, Ohio, is a monopoly spoke that contributed to Piedmont's concentration at Dayton. It is also a monopoly spoke for six other connecting hubs, contributing to the dominance of one carrier at each of those hubs. Nevertheless, Akron has available hundreds of connections to many points as a result of being a spoke city to each of these hubs and, obviously, when Akron passengers move beyond one of the connecting hubs, various competitive alternatives are typically available. Most Akron passengers, in fact, do move beyond these connecting hubs. This is another example of how the hubbing process simultaneously increases concentration at a connecting hub and creates competitive alternatives for passengers moving beyond the connecting hubs.

19. Dresner and Windle (1990) suggested that the effect of hub concentration on airline fares could be explained by the gains to the consumer in the form of frequent flyer benefits. However, their focus is on the difference in fares charged by airline A, flying from X to Y as compared to flying from Y to X. They found that higher fares would be charged on X to Y if the airline was the dominant carrier at airport X but that the fare disparity could be accounted for by the value of frequent flyer benefits. Morrison and Winston (1989) and Borenstein (1989) were concerned with the effect of hub concentration at either the point of origin or destination on the fares charged by airline A relative to its smaller competitors. Their finding that, in this context, hub effects are significant is not challenged by the results of the Dresner and Windle study. The latter, though, does highlight the difficulty of controlling for all the factors besides market share that may explain higher airline yields.

20. The airline industry, in fact, violates all the theoretical conditions for perfect contestability. Contrary to the contestability hypothesis, new entrants to airline markets may be at a significant cost disadvantage because of the existence of economies of scale and scope. For contestability, incumbent firms must be unable to respond quickly enough with a price reduction to foreclose a profit opportunity to entrants; but route fares in the airline industry can be adjusted almost instantly. Contestability also depends on the absence of sunk costs, but a carrier's service and safety reputation is an important aspect of air service, and an investment that is unrecoverable.

21. This advantage is in terms of both higher service quality and lower production costs. The former relates to the carrier's ability to provide more frequent service to a wide variety of destinations. Lower costs are a consequence of the carrier's ability to generate the feed required to run larger planes and to achieve high load factors.

22. Caves et al. (1984) distinguished between economies of firm size and economies of traffic density. The latter focusses on the behaviour of costs, as output is expanded, by increasing service within a given network (number of points served remains constant). The former focusses on costs, as output is expanded, by adding points to a network with a given traffic density. They found there were no significant economies of firm size (unit costs are roughly constant within a broad range of network size), but there were sizeable economies of traffic density (unit costs decline as service within a given network increases). Within this framework, the advantages of larger airlines is explained by their greater ability to increase demand and thereby take advantage of economies of density. If output was measured differently, however, so as to capture differences in the characteristics of the output produced by small and large carriers, it is possible that the marketing advantages of large firms would be reflected in increasing returns to firm size.

23. After adjusting for differences in trip distance and market size, the Secretary's Task Force (1990a) found that fares on trips originating or terminating at the nation's most concentrated hubs averaged 18.7 percent higher. The hubs were: Minneapolis, Cincinnati, Dayton, St. Louis, Pittsburgh, Memphis, Salt Lake City and Charlotte.

24. *De novo* entrants are in a much more difficult position than established carriers who already have built a reputation, and are linked into a frequent flyer program and a computer reservation system. New carriers must deal with these hurdles, in addition to those which confront all aspiring entrants (new carriers and incumbents) to those city-pair markets characterized by a concentrated hub or a scarcity of airport slots and gates.

25. As noted in note 22, these advantages were not reflected in some of the earlier studies of economies of scale which ignored the effect of size on airlines' ability to influence the demand for their services. These studies are the source for the traditional view that the airline industry is not characterized by economies of large-scale production.

26. Besides Sabre and Apollo, the other computer reservation systems are: System One, Pars and Datas 11. In 1988, the five systems generated $1.2 billion in revenue, approximately 70% of which was from booking fees paid by carriers, with the remainder from fees paid by subscribers. Sabre accounted for 38.8% of industry revenue, Apollo 27.6%, System One 16.6%, Pars 11.1% and Datas 11 5.9%.

27. The reasons for this, according to the Secretary's Task Force (1990c, p. 5) are as follows:

> Some CRSs may exhibit superior functionality for booking on the vendor airline, which facilitates more bookings on that airline. In addition, travel agents often have more confidence in the accuracy and timeliness of the seat availability information on the vendor airline and the reliability of having their bookings recorded, which again results in additional bookings. Some agents also maintain that it is easier and faster to make and change reservations, issue tickets and boarding passes, select seats, clear wait lists, and perform several other routine tasks for the vendor airline's flights. Moreover, the ongoing business relationship between vendors and subscribing agents — including the ability to receive preferential treatment — is a major factor in explaining agents' loyalty to their vendor airline.

28. There are four airports in which the Federal Aviation Administration has imposed restrictions on take-off and landing slots: National Airport in Washington, La Guardia and J.F.K. airports in New York, and O'Hare Airport in Chicago.

29. Where carriers provide the financial underpinning for the sale of airport bonds by agreeing to cover any revenue shortfall, these tenant carriers will have a large voice in airport operating and investment decisions. Bailey and Williams (1988) observed that some airports were responding to the resulting problems by attempting to obtain financing on the basis of the underlying strength of air traffic markets rather than on the basis of carrier guarantees.

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## 16

# AN ANALYSIS OF THE CANADIAN INTERCITY SCHEDULED BUS INDUSTRY

Richard Lake,* L. Ross Jacobs and S.T. Byerley**

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## 1. INTRODUCTION

In the late 1980s an average of 20 million intercity passenger trips were taken each year on Canadian scheduled buses,[1] about 30 percent of all domestic trips which involved public transportation. The average distance travelled by these bus passengers was about 145 kilometres. They rode on a variety of vehicles, but mostly on standard, modern, 47-seat, air-conditioned vehicles manufactured in Canada by M.C.I. or Prévost. Bus operations vary widely. Greyhound has 400 buses serving an extensive route system stretching from Vancouver to southwestern Ontario, and north into Yukon and the Northwest Territories. At the other end of the spectrum, Dewdney Trails (until recently Sandy's Bus Lines) operates three times a day each way between Castlegar and Trail, British Columbia, a 30-minute trip. In a more remote setting, Atlin Coach Lines provides service between Whitehorse, Yukon and Atlin, British Columbia for 6 to 11 passengers and freight in a combination van. This report describes the service provided throughout the country, and most of the carriers providing it.

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Regulation of the industry is perhaps its most complicated and confusing characteristic. Originally all bus operations were regulated by the provinces, which owned and maintained the highways. Then, in the early 1950s, the courts determined that bus carriers which operated beyond the boundaries of a province were the responsibility of the federal government. So, the federal government passed a law to delegate its responsibility back to the provinces, and everything remained as it was, and still does. But not in Newfoundland, which is another tale.

This report describes the regulatory environment of the intercity bus industry, the evolution of the present system, the different methods and degrees of regulation in the provinces and the effects of these regulations on the various aspects of the industry — fare levels, competition, cross subsidization of routes and the scope of service. It even explains the special situation involving Newfoundland's primary bus carrier.[2] Also discussed are the incidence of subsidies from public funds and public ownership in the industry.

The high degree of regulation in some provinces and the existence of separate jurisdictions with their varied levels of regulation have prompted consideration of total or partial economic deregulation of the industry. This report suggests how the industry might look if it were deregulated and after a number of years have passed.

The coverage does not include all of the Canadian bus industry. It does not touch on municipal public transit nor on school bus operations. Neither does it discuss tour operations nor the charter bus business, except to the extent that they affect scheduled intercity operations. Most scheduled carriers also provide charter services. Conversely, some charter bus lines operate small scheduled services.

Scheduled bus carriers also operate a network of freight (parcels) services. In some areas, particularly in more remote regions and for carriers serving small communities, this is a very large and profitable segment of a carrier's business. In other parts of the country the freight operations are small or nonexistent. This is true in the densely populated and highly urbanized southern Ontario–western Quebec region, where a variety of courier, messenger and package delivery services compete for this business. In the remote areas, the bus is the only parcel carrier, and other couriers often use the bus service to deliver their packages.

Although these other aspects of the total bus industry are not part of this report, some mention should be made of their somewhat symbiotic interrelationships and their effect upon the intercity carriers.

Most small scheduled carriers and a significant number of midsize carriers achieve most of their revenues from the charter business and, to a lesser extent, from school bus contracts. Many operate one or two scheduled services as required to retain their profitable charter rights. There undoubtedly are a few smaller carriers which are exceptions to this. One is Big Rock Coach Lines, whose service south of Calgary will be described later. Big Rock reports that scheduled service is its major business, and the charter business is small.

Virtually all the larger carriers operate in the charter industry, but it is not their primary business. Both Greyhound and Voyageur Colonial have explained that charter service is marketed as a profitable use of idle bus capacity.[3]

The freight business has been a boon to many scheduled intercity bus carriers. There are carriers who operate on routes whose passenger revenues do not cover costs, but which are profitable because of the revenues from the carriage of parcels. There is discussion in this report of cross subsidization of unprofitable routes by profitable routes, but another important element of the cross subsidization questions involves the support that the passengers and parcels, as joint products, provide for each other.

As mentioned earlier, the extent of freight's importance varies. To Greyhound it provides a third of its transportation revenues,[4] and much of it moves in trucks out of separate terminals. Voyageur Colonial, on the other hand, has considered applying for withdrawal from this business because it is "too much trouble" for the amount of revenue it generates. The company is under the impression, however, that the provincial authorities wish the small town parcel networks to remain.

## 2. WHAT THE BUS INDUSTRY AND PUBLIC TOLD US[5]

During the course of its consultative process, the Royal Commission received submissions and heard from a number of groups and individuals who addressed issues related to the bus industry. These included bus companies, associations representing bus carriers and groups representing users of the transportation system. The latter had relatively little to say about the bus mode. Continuing dialogue between Commission staff and interested persons provided additional information.

Four bus companies made presentations during the Royal Commission's public hearings: Acadian Lines Ltd. of Nova Scotia, SMT (Eastern) Ltd. of New Brunswick, Greyhound Lines of Canada Ltd. and Grey Goose Corporation Ltd.

Greyhound began its presentation by reviewing its recent strategy to reverse a declining ridership. Having proven by experience that product improvement resulted in increased ridership in the past two years, the company believes that further improvements would ensure the industry's future. Intermodal connections and coordination of scheduling between modes would greatly improve the overall efficiency of the transport system. Greyhound also recognized the importance of the relationship between the bus and the tourism industries. Greyhound felt that carriers would need to become more "customer driven" instead of "operations driven" to maintain a presence in tourism.

Greyhound suggested that further deregulation would be a mistake since existing regulations and policies have permitted the orderly expansion of sound, safe and efficient bus operations. If the regulatory environment were altered so that Greyhound lost exclusive operating rights on its more lucrative routes, it would be forced to reduce or eliminate many services it cross subsidizes on non-profitable routes.

Acadian Lines also argued that deregulation would result in a reduction of services. Cross subsidization between passenger revenues, parcel express and charter revenues, and between main routes and regional services ensures, Acadian contended, the presence of a bus service to many communities in Nova Scotia. In a regulated environment, the industry could remain viable without government subsidies.

As a company operating regional carriers in several provinces, Grey Goose was even more vocal in arguing the importance of cross subsidization to maintain rural and regional bus service. According to Grey Goose, scheduled bus services provided by regional carriers are not profitable in themselves, and continued regulation is therefore essential to maintain bus service to the regions. Grey Goose also put emphasis on the development of an intermodal system. The company argued that there is a need for a universal reservation system to resolve scheduling issues and to offer various levels of regularly scheduled service. By integrating local and regional bus service to a national reservation system, any region would benefit from increased accessibility.

In its presentation, SMT Eastern underlined its problems in offering a bus service in a province that has limited air service and no international connections. This lack of air service has been costing SMT and the New Brunswick tourism industry much needed business. As an added frustration, SMT has been unable, because of provincial regulations, to obtain a permit to pick up tours visiting the Maritimes through Halifax International Airport. SMT's view was that although "there must be changes in government policy, we [SMT] also feel that it is up to the various modes of travel to do their part to secure their place in the transportation industry."

The Royal Commission also heard presentations from the Canadian Bus Association (CBA), Ontario Motor Coach Association (OMCA) and from the Association des propriétaires d'autobus du Québec. In their presentations and briefs, all three proceeded to bring the importance of the bus industry within the country's transportation system to the Commissioners' attention.

According to them, the bus industry plays an important role in intercity passenger transportation. More importantly, it could play an even greater role in the future as it is a form of travel that has not yet reached its full potential. There are indeed a number of factors that make bus transportation an attractive mode and alternative to both rail and the car. According to the OMCA, for instance, the bus is the most fuel-efficient mode of transportation. This means it is also the most environmentally friendly. By offering an attractive alternative to travel by car, the motor coach industry offers the consumer the opportunity to help protect the environment.

The bus is also the only public mode of transport linking hundreds of communities and rural areas. It generally offers greater frequency of service on short trips, flexibility in points of departures and arrival and, according to the OMCA, a better on-time performance than rail. The Association contended that the most attractive feature of the bus was its economic efficiency. With minor exceptions, the bus industry is privately owned and generally operates without subsidy. In addition, of all the modes, buses have the lowest operating costs per passenger-kilometre according to the OMCA. (This industry contention is consistent with the Commission staff's costing study conclusions.)

The associations believe that the current uneven subsidy environment with respect to passenger travel results in unfair competition on many domestic routes. Unfair competition will continue to be a fact of life as long as other modes are subsidized, particularly VIA Rail. The CBA believes "this, in turn, ultimately harms the choice available to customers." Given the establishment of a true level playing field, the Association asserted, bus services could be broadened and a better choice of services offered to consumers.

The bus companies and associations cooperated actively with Commission staff in their analysis of the industry, generously providing confidential data and thorough responses to questions. From conversations during the course of this study (with only two marked exceptions), it was clear that the industry favoured the regulated *status quo*.

Many of the groups and individuals who expressed their views to the Royal Commission felt that the surface transport network, including bus, has been neglected and it was in a state of decline. Traveller advocacy groups were not always friendly to the bus mode, and asserted that it should not be assumed that travellers would shift to bus services intended to replace train services. It was stated that bus companies in Eastern Canada, for example, have not benefited greatly from the elimination of many VIA Rail services in the region. For students, seniors, people with disabilities and low-income families who may not have access to a car, mobility is severely reduced by the shrinking number of available transport options.

Representatives of persons with disabilities referred to the bus industry quite often in their presentations to Commissioners. Generally, it was felt that people with transportation relevant disabilities had poor access to bus services. Most terminals and buses have stairs and/or steps but no ramps, and there is usually no room for motorized wheelchairs on buses. It was suggested that funding from all levels of government was required to ensure that accessible intercity buses were provided. Persons with disabilities consider this a basic social requirement.[6]

Remote communities recommended that, where no other public transport is available, local and rural bus routes should be retained even through subsidies. Buses should be used to connect smaller centres with the main rail routes and to provide services to special or remote communities not served by rail.

## 3. INHERENT CHARACTERISTICS OF BUSES

With its high capacity and flexibility, the bus is the most economical public mode of transportation. This is the case if one considers only carrier costs, and it is also true if total costs including full charges for the provision of roads, an allowance for pollution and congestion charges are considered. Some bus capabilities are not present in modes other than the car, and some are quite different from those of any other mode.

Bus operations are very flexible. Any point served by road (even those to which the road is no more than a dirt track) is accessible by bus. Where other modes take at least a few minutes to pick up passengers, a bus can stop and regain cruising speed with little delay. There is almost infinite flexibility in scheduling and adjusting points and times of departure and arrival. Buses can be readily bought, sold and rented. They can be used in scheduled intercity service or as school buses and then chartered during otherwise idle periods. They can be maintained by their owner in a special garage or at the local service station.

An extremely broad range of management and ownership options is possible for a rural or intercity bus operation. An individual, even on a part-time basis, can operate a minivan in scheduled or other service — perhaps as an adjunct to a general store. There are such operators, and there are obvious market niches for them. Equally, there could be a role for the continental carrier.

Although lacking the service life of a rail car or (with maintenance) an aircraft, buses are far cheaper than other passenger vehicles, with the possible exception of the car. Seating density is typically high. As an illustration, for the price of one 37-seat de Havilland Dash 8 ($10 million), or for a substantially lower cost than one train, one could acquire 38 highway coaches with 47 seats each for a capacity of almost 1,800 passengers.

Buses have the lowest operating costs per passenger-kilometre of all the transportation modes. A single driver suffices, and fuel consumption is low. The roads are available on demand for a modest user-fee (fuel tax and licence fee). Consistent with the simplicity of bus operations, overheads are relatively modest. Moreover, on average, intercity buses pay their way in respect to road costs.

Its modest size and cost, and the capability of a bus to stop frequently and on demand, allows it to offer greater frequency of service on short trips and on trips between low-demand origin-destination pairs. The bus mode can also economically provide substantial reserves of capacity on demand. The ratio of peak capacity to average loads is greater for bus than for the other public modes. Bus system capacity can be readily rearranged across routes and types of services. At the seasonal peaks for shorter distance travel, bus continues to deliver long after air and rail are saturated. This is because the cost of intercity coaches is modest relative to aircraft and rail cars; operators can afford to own or rent the capacity to provide this peak service.

The potential performance of the bus is limited by the road. It must share this common-use infrastructure with trucks and cars, and operate at speeds compatible with the presence of these other vehicles.

Buses in normal service usually score relatively low in comfort (particularly space and ventilation) and in amenities provided, including the poor condition of some bus terminals. Higher-class bus services with spacious seats, refreshment service and other amenities are operated and, although there has been some success when the fares are slightly more than for conventional service, premium or luxury bus services have often failed to attract sufficient riders to be viable.

Under almost all circumstances, the bus is environmentally less polluting than the other passenger modes. Fuel consumption, and thus carbon dioxide emissions, are low. Smog inducing emissions are high relative to bus fuel consumption; however, lower-emission diesel engines would seem to lack only an incentive (that is, regulation) for their introduction. Buses are noisier than cars but not more so than the trucks with which they usually share the roads.

# 4. CANADA'S SCHEDULED BUS INDUSTRY

This section provides a description of the scheduled bus industry in Canada, as of 1990. An overview of the industry in Canada is followed by a summary of the regulatory environment in each province. The third subsection describes the structure of the industry and the service being provided. Organized by province as well, it begins in the West with the largest carrier in Canada, Greyhound Lines of Canada. This company serves more than half of the country and can be expected to play an important role in Canadian intercity bus transportation, regardless of any changes to the regulatory or competitive environment.

*The treatment in this section, particularly with respect to the various provincial regulatory regimes (section 4.2) and the intercity scheduled bus carriers and their operations (section 4.3), is intended to be reasonably thorough. Thus, it is lengthy. The reader may prefer to scan this material.*

## 4.1 THE INTERCITY SCHEDULED INDUSTRY

### Operations

While the private car is by far the most used form of personal transportation, for individuals requiring public transportation services, the intercity bus is an important alternative which, until 1983, accounted for more than 50 percent of total travel (in number of trips) by public modes. Although this share declined steadily, bus was not surpassed until 1988 when air travel became the primary public mode of travel. Nonetheless, the bus mode remains an important, although declining, factor in passenger transportation. (In 1988, intercity bus carried 18.2 million passengers.)

Total employees in the bus industry fell steadily from 5,612 in 1980 to 4,700 in 1987. This represents an annual average rate of decline of 2.5 percent. The number of drivers, who comprise the largest portion of the bus work force (about 50 percent) have declined at a somewhat higher rate of 3.3 percent per year. Also, over this period the number of buses declined from 1,700 to 1,350 while the number of miles each bus averaged rose by 7.4 percent.

Intercity busing services are provided across Canada essentially by a network of provincially based carriers that interline at or near their jurisdictional frontiers. Only Greyhound Lines of Canada provides significant multiprovincial service (from British Columbia to Ontario). Most carriers provide only intra-provincial intercity bus service. According to the *Official Canadian Bus Guide*,[7] the intercity bus industry currently provides service to approximately 3,000 points in the 10 provinces and the two territories (down from 3,400 in 1978). Ontario has the greatest number of points (763). Saskatchewan has the second largest number, with 524 points served.

### Finances

From 1980 to 1987, bus company revenues rose 3.5 percent a year while expenses rose 3.16 percent annually. An annual return of 9 to 16 percent was usual. Aggregate data on the financial performance of scheduled service carriers, as opposed to school bus and predominantly charter service operators, are not available. In the years 1990 and 1991, however, results for major carriers appear substantially below returns of the mid-1980s.

In the more populous regions of Canada, most of the small scheduled carriers, and a significant number of the midsize carriers, achieve most of their revenues from the charter business, and to a lesser extent from school bus contracts. The larger carriers virtually all operate in the charter industry, but it is not their primary business. For Greyhound and Voyageur Colonial, charter service is a profitable use of idle bus capacity. In this regard, an efficient scheduled carrier has an advantage in the charter market.

### Industry Concentration

The actual number of scheduled intercity bus carriers is difficult to determine since statistical sources do not agree. The number is between 25 and 45. While Statistics Canada's reporting does not cover all carriers, its reports do represent the vast majority of scheduled revenues generated.

The industry is highly concentrated and is dominated by Greyhound Bus Lines, the intercity passenger arm of Greyhound Lines of Canada Ltd. Although majority ownership is in the hands of a U.S. holding company (not related to Greyhound U.S.), Greyhound of Canada is a publicly held corporation whose shares are traded on the Toronto Stock Exchange. This company provides intercity passenger service from British Columbia through all provinces east to Ontario. In this respect it is the only intercity bus company that may be considered "national" in scope. Its importance may be gauged from the fact that, in 1988, Greyhound Lines of Canada earned $132.9 million from scheduled, charter and courier express operations — 40 percent of the total industry revenues of $332.9 million reported by Statistics Canada for that year.

By 1987, the five largest carriers held nearly 90% of the value of the assets in the industry, earned 84% of the revenues and carried 81% of the passengers, up from 66% in 1980. Employee wages averaged $35,000 per annum at the five largest carriers. This was 27% higher than the next largest group of carriers. Since 1985 only the largest and very smallest firms have had positive rates of returns.

## Regionalization

The industry is highly regionalized, all provinces having at least one major carrier with some, such as Ontario and (more recently) Quebec, having a number of regional carriers. Table 1 illustrates the provincial focus of activity of the major intercity bus operations.

*Table 1*
*MAJOR CARRIERS AND PROVINCES SERVED*

| Carrier | Principal province(s) served |
|---|---|
| Greyhound Bus Lines | British Columbia<br>Alberta<br>Saskatchewan<br>Manitoba<br>Ontario |
| Saskatchewan Transportation Company | Saskatchewan |
| Grey Goose Lines | Manitoba (Ontario) |
| Canada Coach Lines Limited | Ontario |
| Gray Coach Lines, Limited | Ontario |
| Ontario Northland | Ontario |
| Voyageur Colonial Limited | Ontario (Quebec) |
| Autobus Auger Inc. | Quebec |
| Autocars Orléans Express, Inc. | Quebec |
| SMT (Eastern) Ltd. | New Brunswick<br>Prince Edward Island |
| Acadian Lines | Nova Scotia |
| Mackenzie Bus Line Ltd. | Nova Scotia |
| Roadcruiser | Newfoundland |

The geographic dominance of each of these carriers varies from province to province. Greyhound is pervasive in the West, particularly in Alberta (where, with the exception of Calgary–Red Deer–Edmonton and Edmonton–Fort McMurray routes where it competes with Red Arrow, it provides virtually all non-urban services) and British Columbia. However, the locally based "flag" carriers in Saskatchewan and Manitoba control about two thirds of the routes in their respective provinces. Ontario and Quebec are more regionalized. While most of these carriers are identified with one province or provincial region, they often offer some service in neighbouring provinces, and their charter operations may extend over much wider areas. The carriers interline at convenient points to provide a more or less continuous network of intercity services across the country.

### Summary

There has been a steady decline in demand for the Canadian intercity bus since the 1950s, both in terms of total ridership and in terms of its share of the growing intercity travel market. In this context, and given the existing regulatory situation, there was only one way for a carrier to expand its operations — by taking over the route authority of another carrier. The result was greater concentration of the industry through mergers and takeovers. To a degree attributable to provincial regulation, however, this concentration tended to become regionalized, in contrast to the situation in the United States which saw the emergence of two national carriers (now merged).

With the partial exception of Greyhound Lines in western and central Canada, each province saw the rise of one (or perhaps two) large carriers from among a number of smaller operators. Ontario has been an exception to this rule with six larger intercity carriers, but each generally has its exclusive territory. It is noteworthy also that since 1977 Ontario has permitted a second service and thus some competition on certain routes.

The industry has remained viable in the face of declining ridership and increasing costs by cutting back service (route-kilometres) and raising fares. This was accomplished, however, at the penalty of increased unit operating costs (since route-kilometres fell at a slower rate than passengers). Furthermore, fixed costs were spread over a reduced output, making unit costs difficult to control. Finally, in some cases unionized labour may have succeeded in pushing the wage bill higher as prices went up.

## 4.2 REGULATORY ENVIRONMENT

### Provincial Jurisdiction

Each province has jurisdiction over intra-provincial bus operations, scheduled and charter, and each has its own legislation in place to provide for their regulation. Operations of extra-provincial bus carriers — any carrier whose operations extend beyond the boundaries of a single province, including their operations within a province — are under federal jurisdiction. Effectively, any operator that wishes to so arrange its affairs may qualify as a carrier under federal jurisdiction. The *Motor Vehicle Transport Act, 1987* (MVTA, 1987), which replaced the previous MVTA of 1954, is the relevant federal legislation.[8] (The 1987 Act is, for bus, substantially unchanged from the 1954 Act.)

Part I, sections 5 and 6 of the 1987 MVTA delegates authority to provincial transport boards to issue licences and regulate tariffs and tolls for extra-provincial bus undertakings "on the like terms and conditions and in the like manner as if the extra-provincial bus undertaking were a local bus undertaking."

The MVTA, 1987 introduced changes with respect to trucking, most notably a "reverse onus" provision which requires an objector to a licence application to "establish to the satisfaction of the board that the operation . . . would likely be detrimental to the public interest," removing the onus of proof from the applicant. This change did not extend, however, to the passenger sector; no real changes were made with regard to busing.

Interprovincial carriers have through fares which involve transportation in more than one province. As well, interline agreements exist among virtually all scheduled bus lines, allowing carriers to set and quote interline fares between almost any two points. Each province has regulatory authority over the portions of those fares which represent movement over the route segment within its boundaries.

### Federal Jurisdiction

The legislation provides for the federal government to exempt a bus undertaking from the MVTA, which brings it under the provisions of part IV of the *National Transportation Act* and under the jurisdiction of the National Transportation Agency. This provision has been invoked only once.

Canadian National Railways (CN) was authorized by the Canadian Transport Commission (predecessor to the National Transportation Agency) in 1968 to substitute buses for its rail passenger service. The bus service, CN Roadcruiser, applied to the Board of Commissioners of Public Utilities of Newfoundland (PUB) for operating authority under the federal MVTA, but the Commission determined that the operating authority should be under Newfoundland's *Motor Carrier Act*, and this was granted.

Following disallowance of a tariff in 1971, a series of court appeals culminated in a 1975 Supreme Court decision that the service was a part of the total Canadian passenger service operated by CN and therefore should be regulated under the federal legislation.

As powers under the federal legislation are delegated to the provinces, Roadcruiser applied to the PUB for a certificate of authority and approval of its tariff. After public hearings, the PUB issued the certificate, but Roadcruiser appealed tariff restrictions which accompanied it. During the appeal process, relations between Roadcruiser and the PUB deteriorated to the point where buses were ordered off the highways and service halted. At this point the Government of Canada issued an Order in Council exempting the service from the provisions of the MVTA. The Canadian Transport Commission gave Roadcruiser its operating authority and approval of its tariff in 1977.

### British Columbia

Bus transportation is regulated by the British Columbia Motor Carrier Commission under the *Motor Carrier Act*. Regulations cover entry, exit and fares.

The *Motor Carrier Act* specifies that the duties of the Commission are to regulate motor carriers for the purposes of "promoting adequate and efficient service and reasonable and just charges . . . promoting safety on the public highways, and fostering sound economic conditions in the transportation business in the Province."

Operation of a scheduled service requires a public passenger vehicle licence. Charter service can be operated from the same points as the scheduled service or under a limited passenger vehicle licence. An applicant for a licence must make a case for public convenience and necessity.

In its July 18, 1991 project report to the Royal Commission, *Intercity Passenger Bus Regulation in Canada,*[9] Peat Marwick Stevenson & Kellogg made the following observation:

> In practice . . . conditions are much more rigorously applied . . . for regular route service than for . . . charter service. . . . The attitude of the Commission appears to be that the province is well served in regular route service by the existing carriers, notably Greyhound, and that the market is too thin to support competition on existing routes. (p. 21)

Any change in service, including discontinuance, also requires approval of the Commission, and rates must be filed with and approved by the Commission.

### Alberta

Alberta's *Highway Traffic Act* provides for the regulation of motor transport by the Alberta Motor Transport Board, and its framework and authority are set out in the *Motor Transport Act*. A certificate to operate a charter service requires only proof of sufficient insurance and bus safety. Authority to operate a scheduled service, however, requires that a case be made of public convenience and necessity, and objection by an interested party will result in a public hearing.

Generally, there is no competition on routes in Alberta. There are, however, important routes with more than one carrier, but in these instances (Calgary–Edmonton–Fort McMurray) the second entrant made a satisfactory case that its proposed service was distinctive. (See subsection 4.3.)

Tariffs must be filed with the Board with 30 days notice and can be approved, varied or rejected. A hearing is not required but can be held. Maximum fares per mile are approved for a carrier on a system-wide basis, and fares below this level do not require approval.

Schedule changes, including discontinuance, requires 30 days public notice, 14 days advance notice to the Board and the Board's approval.

## Saskatchewan

The Saskatchewan Highway Traffic Board regulates bus operations in the province under the authority of the *Highway Traffic Act*. An operating authority certificate is required from the Board to operate either a charter or a scheduled service. The Board is required to consider an application according to the fitness of the applicant, and whether, in the words of section 4(2) of the Act, the "public business will be promoted by the proposed undertaking." Peat Marwick observed:

> In practice, these conditions are interpreted in a manner which places the burden on the applicant to show the need for the proposed service and to demonstrate his fitness to provide it. It is also relatively easy for an opponent to show damage to an existing service — particularly in a rural province like Saskatchewan. In practice, the procedure amounts to a test of 'public convenience and necessity.' (p. 22)

The province experimented with easier entry for charter operators, similar to the Alberta system, but after six months reinstated the regulations, reportedly because of a large number of frivolous applications.

Approval is required for schedule changes, and proposals to reduce or discontinue a service require a public hearing.

Regulation of fares is similar to that in Alberta, with approval of a standard maximum rate per mile, after consideration of applications of the carriers and their costs. There was no increase for four and a half years between 1983 and 1988, necessitating an increase in 1988 of 32 percent. Public reaction has prompted the Board to recommend automatic annual increases, beginning in 1991, based on a bus inflation model designed by the Board.

## Manitoba

The Motor Transport Board is empowered under The *Highway Traffic Act* to regulate bus transportation in Manitoba. A certificate from the Board is required to operate a "public service vehicle for passengers," whether in scheduled or charter service. An applicant must satisfy the Board that, in the words of section 290(2) of the Act, "the existing facilities for transportation are insufficient, or that public convenience will be promoted by . . . the proposed transportation service." If there is objection to the application, a public hearing is held.

Changes in schedule require the approval of the Board, and application to discontinue service on a route usually results in the Board requiring the carrier first to reduce service for a trial period.

Fare levels are set somewhat as they are in Saskatchewan, with the Board approving a province-wide maximum rate per mile for scheduled and charter services, but with occasional exceptions permitted where conditions warrant. Increases are approved annually, based on financial and operating data provided by the carriers, and the provision in the *Public Utilities Board Act* for a rate of return. The process takes 60 to 90 days and includes public notice and hearings.

## Ontario

There are two bodies in Ontario involved in the regulation of the bus industry. The Ministry of Transportation of Ontario (MTO) issues, cancels or suspends operating licences, and approves licence amendments and fares. The Ontario Highway Transport Board (OHTB) has responsibility to investigate applications and issue certificates or recommendations to MTO. The governing legislation is the *Public Vehicles Act*.

An application for authority to operate a bus service is made to MTO, and it is referred to the OHTB which holds a public hearing. If the OHTB is satisfied that the "public convenience and necessity" warrants the licence, it will issue a certificate with whatever terms and conditions it deems appropriate. Upon submission of the certificate, the Minister (MTO) may, or may not, issue a licence. Before operation begins, the applicant must file a tariff of fares with the MTO, and have it approved as "fair and reasonable." Operations are restricted to the points and the route or routes specified in the licence, and renewal is subject only to renewal of vehicle licence.

There are a number of bus carriers licensed to operate charter and tour service without providing scheduled service. A licence to operate a scheduled service, however, also entitles the carrier to operate charter service from any point on the route. A separate licence is not required.

A carrier is required to give notice to the MTO if it intends to discontinue a scheduled [illegible]. Permission usually is not denied where the licensee can show it incurs unreasonable losses; but the carrier automatically would give up at the same time the contingent rights to operate charter and tour services.

A licensee can apply to MTO to transfer a licence to another carrier; the transfer may or may not be allowed after a public hearing is conducted by the OHTB.

Only fares contained in tariffs filed with and approved by MTO can be charged for bus transportation in Ontario. Increases are automatically approved in the Carrier Licensing Office, where they are filed, if they are within "guidelines" (currently not more than 10 percent per year); a fare increase beyond these guidelines, or any decrease, requires justification and approval by the deputy minister.

A number of individuals interviewed, in the bus industry and elsewhere, alleged that Ontario did not strictly enforce compliance with the regulations pertaining to bus transportation. The two major areas of non-compliance appear to be changes in fares which are not filed with MTO (only fare reduction was noted) and route abandonments without notification to MTO. Initiation of charter and scheduled services without regulatory approval was also alleged.

### Quebec

Regulation of bus transportation in Quebec is provided for by the *Loi sur les transports* (Transport Act), and is the responsibility of the *Commission des transports du Québec* (CTQ).

An applicant for authority to operate a bus service, either scheduled or chartered, must prove the company has the technical and financial ability to provide the service, as well as the inability of the existing carrier to do so. The regulations protect the monopoly positions of carriers on their present routes by making it virtually impossible for a competitor to enter the market.

The only practical way for a carrier to acquire operating rights is by transfer, as was done recently with almost all of Voyageur's Quebec operations. Of course such transfers require approval of the CTQ.

Approval is required to discontinue service, and is granted only after it has been proven that the service is losing money. Such applications are rare, however, given the potential risk of another carrier acquiring operating authority in the area.

There are eight different categories of operating authorities, two of which are for scheduled intercity service and for charter service. In addition, a holder of an intercity authority may operate charter service from within 100 miles of any point the holder is authorized to serve. This results in competition between scheduled and charter operators, as well as between scheduled carriers with contiguous routes, for short-distance charter business.

There have been attempts to relax the regulations in recent years but with no permanent results. (An attempt in 1985 apparently was successfully opposed by Voyageur Inc.[10]) Recently, a Ministère des transports special committee was appointed to study the system.

Carriers are required to get advance approval for their tariffs for scheduled services from the CTQ, which will hold public hearings if, after public notice, the application is deemed controversial; otherwise, the regulator will intervene only if the fares are unjustified. In the great majority of such interventions, however, the carriers have been able to satisfy the CTQ that their costs had increased sufficiently to justify the fare increases.

### New Brunswick

Bus service in New Brunswick is regulated by the Motor Carrier Board (MCB). The *Motor Carrier Act, 1985*, which came into effect January 1, 1988, includes a "reverse onus" provision for bus licence applications. If a carrier applies to operate a scheduled or charter service, section 4(4) of the Act provides that any objection will be dismissed if it "does not establish a *prima facie* case that the granting of the application would likely be detrimental to the interests of the users of public transportation services, to provincial economic or social development, or to intraprovincial, interprovincial or international commerce."

Discontinuance of a service requires a public hearing and an order of the MCB. A carrier cannot "sell, lease, transfer, delegate or assign its motor carrier business or its licence or any right thereunder . . . or enter into a consolidation or merger" without approval.

Tariffs of fares for scheduled service require approval of the MCB after a public hearing; charter rates must only be filed with the MCB.

### Prince Edward Island

Prince Edward Island has a regulatory environment for bus carriers similar to New Brunswick. Its *Motor Carrier Act, 1988*, also contains a "reverse onus" provision.

An objection against an application to the Public Utilities Commission for authority to operate a bus service must be made within 30 days, and the onus is on the objector to provide evidence that granting the authority "would be likely to be detrimental to the public interest."

There appears, however, to be a difference once a hearing is called. The Commission must then consider, in addition to "detrimental effect," whether there is "a likelihood that the proposed motor bus service will be conducive to public convenience." There has not been a case heard under this legislation, so the Commission Chairman was not able to speculate as to how it might be interpreted, except to suggest that a decision probably would be based on the balance of evidence, rather than there being an onus on one party.

Authority is not required to operate a service with vehicles of 16 seats or less.

An order of the Commission, after a public hearing, is required for a service to be discontinued or abandoned, but no transfer of an operating authority is permitted.

Fares must be filed with and approved by the Commission; applications for increases are approved if found to be "economically reasonable and viable."

### Nova Scotia

The Board of Commissioners of Public Utilities regulates the bus industry in Nova Scotia under authority of the *Motor Carrier Act*. Market entry and exit and fare levels are strictly controlled.

Authority of the Commission is required to operate a scheduled or charter bus service, to discontinue or abandon service, to sell, transfer, assign or lease an operating authority or to increase fares. None of these authorities is granted without a public hearing.

In considering whether to grant a licence to operate a bus service, the Commission, according to the Act, may consider among other things, the objection of any person already providing transportation on the same route by any mode, on grounds that existing service is adequate or, if the licence is granted, will be in excess of requirements.

**Newfoundland**

As described earlier, the major intercity bus carrier is regulated by the federal government (National Transportation Agency). As well, there are several smaller carriers operating under provincial legislation.

The Newfoundland *Motor Carrier Act* requires the operator of any bus service, scheduled or charter, to apply to the Board of Commissioners of Public Utilities of Newfoundland (PUB) for a certificate of public convenience and necessity. The Act sets out what the PUB may consider in its determination of whether to grant a certificate, and the wording is almost identical to that contained in the Nova Scotia legislation.

PUB approval is required to discontinue a service, or to sell, transfer, assign or lease an operating authority.

Fares must be approved by the PUB, but changes to the legislation in 1987 stipulate only that fares not exceed an approved level. Thus, reductions — permanent or temporary — can be made without application to the Board.

**Summary**

Responsibility for extraprovincial carriers is delegated, under the MVTA, to the provinces. The sole exception is CN Roadcruiser, the major carrier in Newfoundland. Eight of the provinces will grant authority to operate a scheduled intercity bus service only if the applicant proves public convenience and necessity; a public hearing is held if there is any objection. New Brunswick and Prince Edward Island removed this requirement in 1987 and now have a "reverse onus" test: an application is denied only if it is proven it would be detrimental to the public interest. In every province, changes to or discontinuance of a service requires approval.

Fares must be filed with the regulatory authority in every province, and require approval in all but Quebec, where the CTQ intervenes only if the fares are "unjustified." In Alberta, Saskatchewan, Manitoba and Newfoundland, only maximum fare levels are approved. In Ontario, public hearings are required before fare increases can be approved.

Charter services require separate licences in seven provinces. In British Columbia, Ontario and Quebec, a licence may authorize operation of a charter service only or authorize both scheduled and charter services. The "reverse onus" test applies in Alberta for charter service, as is the case in New Brunswick and Prince Edward Island.

## 4.3 CARRIERS OVERVIEW

This section describes the general structure of the industry and the service being provided. Major scheduled carriers and those of intermediate and smaller size whose services are advertised nationally are all included. Carriers operating only charter services are not included. A sample of the operations of smaller carriers is given to provide a flavour of local services; some small bus operations are not known beyond their local market.

A phenomenon which persists in many parts of the country is the smaller bus company which is essentially a charter (and tour) operator, but which also operates one or more small local scheduled services. This is a result of the requirement in most provinces to prove public convenience and necessity in order to acquire authority to operate any bus service. It is most often the charter and tour market which attracts an enterprise to seek such authorities. In a number of provinces, a licence to operate a scheduled service brings with it the right to operate charter services in the same county or region. (Normally, the charter service licence allows operation *from* the county or region, *to* anywhere in Canada and into the U.S.) It is easier to prove a need for a scheduled service on a route where there is none and where there is insufficient traffic to attract the large intercity carriers, than to prove that public convenience and necessity will be served with another charter bus operator. As a result, in such jurisdictions, a number of these small local services prevail. The extent of this phenomenon is a function of the size of the perceived charter market in the region, not the market or need for the scheduled service, nor its potential profitability.

### British Columbia and Yukon

Greyhound Lines of Canada dominates the intercity bus mode in British Columbia, Yukon and Alberta, and operates the only really interprovincial route in the country, from the west coast to southern Ontario along the Trans-Canada Highway system. Canada's largest carrier is the exception in an industry that is predominantly controlled by Canadian interests. Greyhound Lines of Canada Ltd., a public company, is 31 percent owned by Canadians and 69 percent by a United States holding company.

In British Columbia, Greyhound operates an extensive network of routes:

- east to Alberta, from Vancouver via the Trans-Canada and Coquihalla highway to Calgary, via the southern route through Princeton, Castlegar and Cranbrook to Fort Macleod, and from Prince Rupert via the Yellowhead to Edmonton;
- north-south routes through the Okanagan Valley, through the Kootenays between Cranbrook and Banff, the South Yellowhead north from Kamloops, and the Cariboo route between Cache Creek and Prince George;
- north on the Peace River highway to Dawson Creek, and on the Alaska Highway to Whitehorse in Yukon.

The *Official Canadian Bus Guide*[11] shows 13 other bus lines operating in British Columbia and one in Yukon. They are generally contiguous to Greyhound, rather than parallel, and serve as extensions, complements or feeders to its network, not competitors.

There are four lines serving Vancouver Island. The major service is provided by Vancouver Island Coach Lines (VICL). Orient Stage Lines operates a service from its connection with VICL at Port Alberni to Tofino on the west coast of the Island. Connections from Vancouver to the Island are provided by Pacific Coach Lines to Victoria, and Maverick Coach Lines to Nanaimo.

Maverick also provides services over two routes north from Vancouver to Powell River and Mount Currie. Cascade Charter Service Ltd. provides services out of Vancouver, operating along both sides of the Fraser Valley to Mission and Harrison Hot Springs.

The two major U.S. carriers, Greyhound Lines, Inc. and Trailways (Northwest), provide competing services between Seattle and Vancouver. Greyhound has six departures per day in each direction, Trailways two. Both of Trailways' departures appear to be scheduled to compete with Greyhound. (Since the purchase of Trailways by Greyhound in 1988, such competition is probably only academic.) Service between British Columbia and the State of Washington is also provided by Empire Lines Inc., Creston to Spokane, and Osoyoos to Spokane and Yakima.

Dewdney Trails is a charter and tour operator in Trail, and serves as an agent for Greyhound. It operates a regular service three times a day between Trail and Castlegar. This is a 30-minute trip, scheduled to provide connections with every bus on Greyhound's interprovincial service through Castlegar.

There are a number of similar connections, in northern areas of the province, which also extend Greyhound's routes into more remote areas. Vista Bus Service of Tumbler Ridge, a charter operator and Greyhound agent, has a scheduled service to meet the Edmonton buses at Dawson Creek. Another charter and tour operator, and Greyhound agent, Seaport Limousine Ltd. of Stewart, meets the buses to and from Prince Rupert at Terrace. Connecting with the same Greyhound route, as well as the Stewart bus, is Farwest Bus Lines of Kitimat. Both companies also serve the Terrace airport.

Beyond Greyhound's route to Whitehorse in Yukon, a tri-weekly service is provided to Dawson City by Norline Coaches. Gray Line of Alaska provides a summer service from Anchorage to Whitehorse, connecting with Greyhound. Peace Coach Lines (a charter line, also operating as Diamond Dee Tours) provides service between Chetwynd and Fort St. John, via Hudson Hope. One of the smaller carriers, Atlin Coach Lines, is authorized to operate a vehicle with between 6 and 11 seats between Whitehorse and Atlin.

Not all of these small remote schedules provide direct connections with Greyhound's buses, and not all of the carriers serve as Greyhound agents. There is, nevertheless, an informal network of these feeder bus lines maintaining service to a number of remote and thinly populated locations. Since they are virtually all charter and tour operators first, it is reasonable to speculate that these operations subsidize the scheduled services, with some help from Greyhound commission revenues.

### Alberta and Northwest Territories

As in British Columbia, Greyhound is the dominant carrier in Alberta. It provides service between the British Columbia and Saskatchewan borders along the Trans-Canada Highway and on the southern route through

Lethbridge. It serves the main north–south artery between Lethbridge, Calgary, Edmonton and Fort McMurray, together with a number of contiguous routes to the east and west. From Edmonton it serves the northern areas of Cold Lake, Slave Lake and Peace River, extending as far north as Hay River in the Northwest Territories.

It is in the latter northern extremes of Greyhound's Alberta and Northwest Territories network where the feeder carriers operate. LaCrete Bus Lines of LaCrete, operates a bus which connects at High River with the Greyhound service between Peace River and Hay River. Arctic Frontier Carriers Ltd., of Yellowknife, operates charter and school buses as well as a local scheduled service to Rae, and a tri-weekly service to Hay River. At Hay River, it connects with Greyhound, and with a similar carrier, North of 60 Bus Lines, from Fort Smith.

Greyhound has some competition in Alberta from Red Arrow Deluxe Service of Edmonton.[12] Red Arrow made a case before the Motor Transport Board in Alberta that there was a distinct unserved market for a "deluxe" express bus service between Edmonton and Calgary, and between Edmonton and Fort McMurray, using downtown hotels as terminals. It is the equivalent of the air industry's "business class," and the fare is $4 per round trip higher than Greyhound's. When Red Arrow's route authorities were originally obtained, local service was required; this was later abandoned.

A recent report[13] made available by Transport Canada, described a new carrier, Big Rock Bus Lines of Okotoks, which was granted permission almost two years ago to provide service into Calgary from Okotoks, High River and Turner Valley. This is a commuter service with buses operating into Calgary in the morning and back out in the late afternoon. These routes are inside a 40 mile radius of Calgary. Okotoks and High River are also served by Greyhound's Calgary–Lethbridge local service, which may well share some of this commuter business. The one-way fare between Okotoks City and Calgary is $4.05 on Big Rock, compared to Greyhound's $3.65. According to Greyhound, its Okotoks fare has not been adjusted since the Big Rock service began, except as the result of province-wide rate increases.

**Saskatchewan**

Greyhound operates across Saskatchewan on the Trans-Canada Highway from Alberta through Maple Creek, Swift Current, Moose Jaw, Regina, and

Moosomin into Manitoba. It also operates the more northerly route from Alberta through both Lloydminster and Wainwright to North Battleford. This route continues east through Saskatoon, Lanigan and Yorkton, into Manitoba through both Roblin and Russell.

The only "local" service provided by Greyhound in Saskatchewan is a Regina-to-Winnipeg route through Reston, Manitoba. This serves a local market, probably at a financial loss, but provides a feed from the region to Greyhound's Trans-Canada service, which might make it a viable operation overall. There probably are other local Greyhound services in Alberta and British Columbia in this category.

While Greyhound provides the "main road" interprovincial service through Saskatchewan, most of the intra-provincial route network belongs to Saskatchewan Transportation Company (STC), a provincial Crown corporation. On most of Greyhound's routes, there is no STC service, but there is on some (Regina to Moose Jaw, and Saskatoon to North Battleford and Marsden are examples). Greyhound also "pools" with STC between Saskatoon and Alsask. On such routes there is potential for competition between the two. Fares have to be approved by the provincial authorities, however, and no price differentials exist. Any competition must, therefore, be based on service and schedules.

There are a few small operators in Saskatchewan such as:

- Leader Carriers Ltd., which operates between Swift Current and Leader;
- Western Trailways Motor Coach Lines Ltd.,[14] between Saskatoon and Eston;
- Moose Mountain Lines Ltd., between Regina and Rocanville;
- Frances Enterprises Ltd., between Regina and Maryfield; and
- Hertz Bus Lines, between Regina and Bengough.

In Saskatchewan, the right to operate a scheduled line service does not bring with it any right to operate charter or tour services. They must be applied for separately. There is not the incentive, therefore, that exists in other provinces for a charter operator to subsidize a scheduled service. There are bus carriers operating both services in Saskatchewan, but they are apparently not cross subsidizing.

Two provincial government programs ensure service to communities without sufficient traffic potential to make scheduled bus operations commercially viable. These are the Rural Bus Subsidy Program and the Rural Transportation Assistance Program, and are in addition to the indirect subsidy resulting from the government's ownership of STC. These programs and STC are discussed in section 11.

### Manitoba

The situation in Manitoba is similar to that in Saskatchewan. Greyhound operates service through the province from Saskatchewan, on the Trans-Canada Highway from Regina, and on the more northerly routes from Saskatoon and Yorkton. There is also the "local" route between Regina and Winnipeg through Reston, described earlier. From Winnipeg, the Greyhound service into northern Ontario operates along the Trans-Canada. As well, there is a local service, five times a week, via the old Trans- Canada (now Highway 44), through Rennie and Whiteshell Provincial Park.

Greyhound provides local service over its interprovincial routes, but most intra-provincial service in Manitoba is provided exclusively by Grey Goose Bus Lines Ltd. Grey Goose is owned by Laidlaw Inc., which in turn is part of Canadian Pacific. Laidlaw also owns Vancouver Island Coach Lines Ltd., which provides most of the service on Vancouver Island, as described earlier.

Grey Goose serves a comprehensive network throughout Manitoba, including regular service to the North, as far as Flin Flon, Lynn Lake, Thompson and Gillam. It also provides service to and within northern Ontario.

For the most part, Greyhound and Grey Goose do not compete. However, there are no restrictions on either's rights to pick up or let off passengers over their routes, so they do compete where their routes overlap. This situation exists on Greyhound's northerly routes between the Saskatchewan border and Winnipeg, and along the Trans-Canada between Winnipeg and Portage la Prairie. They also compete technically between the cities of Winnipeg and Brandon, but Greyhound operates over the direct Trans-Canada route, and Grey Goose has only its local circuitous service using the highways south of the Trans-Canada.

Similarly, both provide interprovincial service via different routes between Winnipeg and Thunder Bay. Greyhound follows the Trans Canada Highway through Kenora, while Grey Goose uses the route south of the Lake of the Woods, through Minnesota. Triangle Transport has recently replaced Greyhound Lines Inc. (of the U.S.) on the route from Fargo, North Dakota to Winnipeg.

Technically there are two other intercity carriers in Manitoba, but both can be disregarded in the context of this paper. Beaver Lines, a charter operator, provides a commuter service between Winnipeg and Selkirk, with a commuter tariff (discounted multi-voyage tickets, etc.). There are a number of charter bus lines in northern Manitoba, one of which, Northern Bus Lines of Flin Flon, has contracts to operate a few Grey Goose routes, but legally these are Grey Goose services.

### Northern Ontario

In northern Ontario, Greyhound continues its service along the Trans-Canada Highway from Manitoba east through Thunder Bay, Sault Ste. Marie and Sudbury, then south to Toronto. As well, it provides service between Thunder Bay and Hearst, and between Sudbury and North Bay.

Grey Goose connects Manitoba and Thunder Bay, through Minnesota, provides services from Thunder Bay to Armstrong and over the same route as Greyhound to Hearst. Each carrier provides service once daily or five days a week to Hearst, at different times of the day, probably more complementary than competitive.

The Ontario Northland Transportation Commission (ONTC) operates bus services, as well as the Ontario Northland Railway, on behalf of the Ontario government. It has a bus service between Hearst and North Bay, which also serves Timmins. This service connects with both Greyhound and Grey Goose at Hearst, at North Bay with Voyageur Colonial to Ottawa and Montreal, and until recently with Gray Coach Lines to Toronto. ONTC also provides service between Timmins and Sudbury, and between Timmins, Wawa and Sault Ste. Marie. The latter two communities are also part of Greyhound's trans-Canada service four times a day.

Ontario Northland and Gray Coach had, for some time, a bus pooling agreement between Timmins and Toronto, on the routes via Sudbury and North

Bay. This enabled passengers to travel between Timmins and Toronto without a change of coach. In an important development, the provincially owned ONTC, that used to connect with Gray Coach to and from Toronto, has bought Gray's major routes between Sudbury and Toronto and between North Bay and Toronto. Now it must be considered a major "trunk line" intercity carrier. Significantly, a Crown-owned carrier has entered a major intercity market in competition with an incumbent, privately owned operation. This is inconsistent with the recent trend in Canada and elsewhere.

In Ontario, most of the local scheduled services to remote or thinly populated areas not served by the larger regional carriers are provided by small bus operators whose primary business is charter, tour and/or school bus services.

Two small bus lines operate in northern Ontario, according to the *Official Canadian Bus Guide.*[15] Excel Coach Lines of Kenora, operates daily services south to Fort Frances, and north to Red Lake; A.J. Bus Lines of Elliot Lake operates a route to Serpent River and links the communities of Manitoulin Island with Espanola.

### Southern Ontario

Two bus services join northern and southern Ontario. The final leg of Greyhound's trans-Canada route operates as an express service only between Sudbury and Toronto. Until recently, Gray Coach Lines, Inc., of Toronto operated over the same route, with one express service a day, and another weekend express service, in direct competition with Greyhound, but at the same fares.[16]

Gray Coach also provided a daily local service to Sudbury, and another to North Bay, both of which connected with the Ontario Northland service to Timmins. As previously explained, Gray Coach and Ontario Northland had a bus pooling agreement between Toronto and Timmins, on both routes. The sale of Gray Coach's rights to operate between Toronto, Barrie, Sudbury and North Bay was mentioned above. Also included in the sale were Gray's rights to operate via Barrie to Penetang (Penetanguishene), Collingwood and Owen Sound, and some coaches.

Within southern Ontario, Gray Coach operates services from Toronto to the Niagara Peninsula and across the border to Buffalo, New York, as well as to

Guelph, Kitchener and Brampton, and north to Owen Sound via Highway 10 from Brampton and via Highway 6 from Guelph.

Greyhound operates express service from Toronto to London and the Windsor–Detroit gateway, directly via Highway 401, and also local service via Highway 2, through Hamilton. There are as many as 14 daily departures in each direction between Toronto and London, including one with "V.I.P." service (low-density seating, videos, and beverage and snack service) with a surcharge of $6 each way. As well, Greyhound operates a local service between London and Windsor along the lake shore via Highway 3, and a through service from Toronto to the Niagara Falls and Buffalo gateways.

Ontario regulations require proof of public convenience and necessity for rights to be granted to operate a bus service. The phenomenon, described earlier, of entry to the charter market by proving the need for a scheduled service, is common in Ontario, and there are a number of charter operators with local scheduled line services.

Those listed in the *Official Canadian Bus Guide*[17] which apparently fit into this category are:

- Sherwood Transportation, operating between Goderich and Stratford;
- Cherrey Bus Lines Inc., operating between Palmerston and Stratford;
- McCoy Coach Lines, operating between Simcoe and Nanticoke, Tillsonburg and Hamilton;
- United Trails Inc., operating between Kitchener and Elmira, and between Guelph and Port Dover;
- Farr's Coach Lines Ltd., operating between Hamilton, Welland and Dunnville, and between Port Colborne, Welland and St. Catharines;
- Pacific Western Transportation, operating between Toronto and Beaverton; and
- McGinnis Coach Lines Inc., operating between Belleville and Picton.

Questions to these operators elicited similar responses indicating that scheduled line-haul service generally provides less than 10 percent of their revenue.

There are a few bus operators in this category with more extensive networks of scheduled routes. One is Penetang-Midland Coach Lines Ltd., which provides at least three scheduled daily departures each way between Toronto and Penetang, and at least two a day to and from Owen Sound. Can-Ar Coach Service of Concord has an even larger network of scheduled services. It operates northwest from Toronto to Southampton in the Bruce Peninsula, northeast to the Lindsay–Peterborough area and as far north as Haliburton, but is primarily a charter and tour operator.

There are, however, a few carriers whose scheduled line operations are more significant. Canada Coach Lines Ltd. is owned and operated by the Hamilton Street Railway which in turn is owned by the Regional Municipality of Hamilton-Wentworth. It provides scheduled bus service between Hamilton and Toronto Airport, Niagara Falls, Buffalo, Brantford, Kitchener and Guelph, as well as charters and tours. The scheduled service consumes 48 percent of its bus miles, and provides 30 percent of its operating revenue. Chatham Coach Lines and its subsidiary Cha-Co Trails operate extensive services throughout western Ontario (Windsor, Leamington, Chatham, Sarnia, Port Stanley, London, Kitchener, Owen Sound, Goderich) and earn most of their revenue from that element of the business, although they also have charter and tour services.

GO Transit is the commuter rail system operated by the Government of Ontario to serve the Greater Toronto area; it also operates a network of bus routes as an extension of the rail system.

Adirondack Trailways (part of the U.S. Trailways system now owned by Greyhound) operates between Cornwall and New York State, with direct service to Albany and New York City.

There is one other major carrier in Ontario, which provides the bus link to Quebec. Voyageur Colonial Ltd. operates express and local service in the Toronto–Ottawa–Montreal triangle. It also provides service between Toronto, Peterborough and Pembroke, and between Ottawa and Hawkesbury, Cornwall, Kingston and North Bay. As well, it serves some routes between Ottawa and Quebec–Ottawa to Maniwaki and Grand Remous, to Mirabel Airport and to Montreal via the north shore of the Ottawa River. Voyageur Colonial is what remains of what was, until earlier this year, not only the sole scheduled intercity carrier in the triangle, but throughout the province of Quebec as well.

## Quebec

Scheduled intercity bus service in Quebec was once provided almost exclusively by the Provincial Transport Company. Provincial merged with Colonial Coach Lines, to form Voyageur Enterprises Ltd., the former parent of Voyageur Inc. and Voyageur Colonial (VCL), under the eventual ownership of Canada Steamships Lines (CSL). Voyageur dominated the markets of Quebec and eastern Ontario. The company's traffic levels peaked in 1978, but since then a declining market, combined with labour and financial problems, forced a reorganization of CSL's bus interests late last year. As a result, by the end of March 1991, the structure of intercity bus transportation in Quebec had changed considerably.

The rights to serve particular routes were divided and sold to three groups of companies. The division was made in such a way that each of the new enterprises got a proportionate share of "good" and "bad" routes — a built-in design for cross subsidization. The remaining routes, those in or into eastern Ontario which were described earlier, together with the Ottawa and Montreal bus terminals, remained with the restructured Voyageur Colonial Ltd. Ownership of the Montreal terminal has since reverted to VCL's parent company (CSL).

Autobus Auger Inc. of Chateauguay, south of Montreal, acquired the rights to provide service on the Montreal–Sherbrooke–Quebec City route, and between Montreal and the far northern communities of Val d'Or, Chibougamou, Matagami, LaSarre, Rouyn-Noranda, and from Rouyn-Noranda to Kirkland Lake in Ontario, thence south to North Bay.

Some former Voyageur managers founded Orléans Express Inc., and acquired the routes between Montreal and Quebec City, via Trois-Rivières, between Quebec City and the Gaspé, and the routes within the Gaspé peninsula. The more remote routes, on the north shore of the St. Lawrence River from Quebec City to Baie-Comeau, Sept-Îles, and the Lac-St.-Jean region, are being served by Jasmin-Fournier, Inc.

Finally, because it is interprovincial, the route between Rivière-du-Loup, on the south shore of the St. Lawrence, and Edmundston, New Brunswick, could not be transferred to any of the new carriers. Eventually, special arrangements were made between Quebec and New Brunswick to allow SMT (Eastern) of New Brunswick to serve it.

The new order in the bus industry serving Quebec — a number of regional carriers rather than one major carrier throughout and beyond the province — was discussed with one of its principal architects, the President of Voyageur Colonial Ltd. It was designed to save Voyageur from increasing losses, and at the same time, to prevent the complete loss of a viable intercity bus system in Quebec.

The continuing failure of Voyageur Colonial to rid itself of increasing operating losses was attributed to two main categories of problems. One was the steady decline in bus traffic since 1978, exacerbated in 1984 and 1985 by significant reductions in fares by VIA Rail Canada in attempts to build its market share in the Quebec City–Windsor corridor. The other was the proliferation of labour unions at Voyageur.

In 1980, the combined VCL and Voyageur Inc. employees were represented by 10 separate unions. One was an in-house organization, the others were affiliated with either the International Teamsters, the Canadian Brotherhood of Railway, Transport and General Workers (CBRT), or the Confédération des syndicats nationaux (CSN). This situation was largely the result of mergers and acquisitions. Each union negotiated independently, and any labour action by one union, such as work stoppage, was generally respected by the others, resulting in either severe impairment or a total shut-down of operations. Sizeable losses resulted from these interruptions, and labour costs grew considerably higher than the industry average — too high to enable profitable operation of the network in a period of passenger demand decline.

The new carriers did not inherit the full extent of these burdens, but Voyageur still has the high wage levels if not as many unions. The 1991 rate for a bus driver at Voyageur is approximately 15 percent higher than at Greyhound. Voyageur obviously expects that its new condensed network, which includes several of the highest volume routes in the country, together with much lower overhead and significant union concessions, will allow it to attain financial viability.

### New Brunswick

SMT (Eastern) operates the only province-wide scheduled intercity bus service in New Brunswick. It serves routes between St. Stephen, Saint John, Moncton, Chatham and Campbellton; Saint John, Fredericton, Bathurst and

Campbellton; and Moncton and Edmundston. Its routes extend about five miles into Nova Scotia, to connect with Acadian Lines at Amherst Nova Scotia (where ongoing passengers must change coaches); and into Quebec about 75 miles from Edmundston to Rivière-du-Loup, the route once operated by Voyageur (again, passengers must change at Rivière-du-Loup). It also operates the regular service to and within Prince Edward Island.

SMT has recently reached agreement to operate to Bangor, Maine, with a connection with Greyhound Lines Inc. to Boston.

As well, there are 10 other carriers licensed for scheduled service. Most of these operate rural school bus or airport minivan services. A few operate standard coach service, usually on short routes. One example is A & L Transit, operating between Chatham and Newcastle, a distance of less than 10 miles.

There have been only three new licences for scheduled services under New Brunswick's "reverse onus" regulations, and about 10 new charter licences. A number of these new charter licences have resulted from applications by existing charter operators whose territory was limited to as little as a single county, seeking authority to extend their territory to include the entire province.

### Prince Edward Island

SMT (Eastern) of New Brunswick has the only year-round interprovincial bus service in Prince Edward Island, operating between Charlottetown, Kensington, Summerside, Borden and on the ferry service to Cape Tormentine.

There are a number of charter operators, one of which, Trius Motor Coach Tours, operates some local scheduled services, which complement rather than compete with SMT. In addition, there is the provincial government-owned Island Transit, which has operated scheduled services in the summer only, applying for approval every year for temporary schedules and fares. Island Transit does not operate charter or tour services.

Until this year, Island Transit operated a summer service from Charlottetown to New Glasgow, Nova Scotia, via the Wood Islands ferry to Caribou, Nova Scotia, making a direct connection with Acadian Lines. This summer the service is being operated on a trial basis by Trius, under temporary authorities from both provinces.

## Nova Scotia

The major intercity bus carrier in Nova Scotia is Acadian Lines. It provides service on routes between Halifax and Yarmouth through the Annapolis Valley, between Halifax and Amherst, connecting with SMT (Eastern) service to New Brunswick, and between Halifax and Sydney on Cape Breton Island.

A few small bus operations complement Acadian's service. MacKenzie Bus Line Ltd. serves the route between Halifax and Yarmouth via Highway 103 along the south shore, and Zinck's Bus Co. Ltd., provides service between Halifax and Sherbrooke, east along the south shore on Highway 7. Al's Cabs and Vans Limited operates vans and a 15-passenger minibus on the 90-mile route between Antigonish and Canso. Transoverland Ltd. operates a daily service between Cheticamp, on the Cabot Trail, and Sydney.

## Newfoundland

Canadian National Railways (CN) operated a regular rail passenger service in Newfoundland from 1949, when Newfoundland became a province of Canada, until the Canadian Transport Commission permitted CN to abandon the rail passenger service and substitute a bus service. The bus operation, CN Roadcruiser, was introduced in December 1968 and operated parallel to the rail service for six months before final authority was granted to abandon the latter.

CN Roadcruiser currently operates a daily service on the Trans-Canada Highway between St. John's and Port aux Basques, where connection is made with the Marine Atlantic ferry service to North Sydney, Nova Scotia. A fleet of 25, 47-seat MCI buses is used. Terminal facilities are provided at former railway stations in St. John's, Grand Falls and Corner Brook, leased space at Gander and Stephenville airports, and the Marine Atlantic terminal at Port aux Basques. Roadcruiser loses money.

There are approximately 50 scheduled services authorized under the Newfoundland and Labrador *Motor Carrier Act* to operate in Newfoundland, connecting virtually every population centre with one or more Roadcruiser points. Generally these are local routes with low traffic density, and most carriers use vans or minibuses.

Only four or five of these operations use full-size buses. Some are the 47-seat Prévost or MCI type, but some are the smaller Bluebird type or converted school buses. One of these operations serves a route from St. Anthony in the far north of Newfoundland to Deer Lake and Corner Brook. Another operates between Cannings Cove on Bonavista Peninsula and Clarenville and St. John's. There is also a service which connects St. John's with Argentia and the ferry service from North Sydney, Nova Scotia.

### Summary

In Western Canada, Greyhound is the dominant carrier. It operates a through service from Vancouver to Toronto, then to Buffalo and Windsor. It is also the major carrier throughout British Columbia and Alberta. There are two major regional carriers in Western Canada: STC provides intra-provincial services in Saskatchewan, as does Grey Goose in Manitoba and northwestern Ontario. In addition there are a number of small local services in specific regions not served by these major carriers. Five of these operate in the southern mainland of British Columbia and on Vancouver Island, one in the Trail-Castlegar area, and about eight in northern British Columbia, Alberta, the Northwest Territories and Yukon. As well, there are a number of small connecting and supplementary services in Saskatchewan, some of these assisted by provincial subsidy programs, and two in northwestern Ontario. In Alberta there is one real example of competition to Greyhound: Red Arrow's higher-priced "deluxe" service between Edmonton and Calgary, and between Edmonton and Fort McMurray.

Ontario Northland, and Greyhound, join northern Ontario to Toronto. There are six significant regional carriers (including Gray Coach) providing service in southern Ontario. This includes Voyageur Colonial, which is the dominant carrier in southeastern Ontario. There are at least seven small carriers providing service on local routes. Generally, these are primarily charter and tour bus operators. Apart from some overlapping of routes in southwestern Ontario, the only real competition seems to be between Greyhound and Gray Coach on the Sudbury–Toronto and Toronto–Buffalo routes.

The former dominant carrier in Quebec, Voyageur, has divested most of its routes in that province, which are now served by four regional carriers.

SMT (Eastern) remains the only significant carrier in New Brunswick and Prince Edward Island, despite loosened entry regulations. Acadian Lines is the dominant carrier in Nova Scotia, and Roadcruiser in Newfoundland. There are about 10 small carriers licensed in New Brunswick, two in Prince Edward Island, four in Nova Scotia and as many as 50 in Newfoundland. However, most of these small carriers (almost all of the ones in New Brunswick and Newfoundland) operate very short feeder or airport services using vans or minibuses.

There are publicly owned intercity bus carriers in Canada. These include Newfoundland's Roadcruiser, owned and operated by Canadian National; Saskatchewan Transportation Company and Ontario Northland Transportation, both provincial Crown corporations. Canada Coach Lines is municipally owned and operated.

## 5. COMPARATIVE FARE LEVELS

### INTRODUCTION

An important aspect of intercity bus regulation in Canada is the regulation of fares. The range and variance of regulated fares help provide an understanding of regional differences in the Canadian bus industry and how changes in the regulatory regime might affect it. Published bus fares[18] in different regions and situations are examined below. Unless otherwise stated, circumstances are reported as of July 1990. Regardless of differences in exit and entry regulatory practices in different jurisdictions, every province requires at least that maximum fares be approved by its regulatory agency.

#### Interprovincial

Fares are approved by the individual provincial regulatory authorities. This includes the portions of interprovincial fares which apply to the route segments within the provinces. Thus, the fare levels for Greyhound's trans-Canada service vary from province to province. There is a through rate from Vancouver to Toronto (as of mid-1990 it was $220, about 8¢ per mile),[19] which is lower than the sum of the individual segments. The fares per mile for segments within the provinces, listed in Table 2, illustrate the differences between the provinces.

*Table 2*

### LOCAL FARES, GREYHOUND'S TRANS-CANADA SERVICE

| Province | Fare per mile |
|---|---|
| British Columbia | 12.3¢ |
| Alberta | 13.7 |
| Saskatchewan | 12.0 |
| Manitoba | 12.0 |
| Ontario | (varies) 15.3–17.4 |

The mid-1990 through fare, Vancouver to Halifax[20], was $320, and fares for the segments east of Toronto with the carrier serving each segment, are shown in Table 3.

*Table 3*

### LOCAL FARES, TORONTO TO HALIFAX SERVICES

| Province | Fare per mile | Carrier |
|---|---|---|
| Ontario | 16.1¢ | Voyageur Colonial |
| Quebec | 19.1 | Orléans Express |
| New Brunswick | 17.3 | SMT (Eastern) |
| Nova Scotia | 14.5 | Acadian Lines |

As can be seen, there are differences in overall fare levels from province to province.[21] Alberta mid-1990 fares were higher than those in the other western provinces, but fares in Western Canada were significantly lower than those in Eastern Canada. In the east, Nova Scotia had the lowest fares and Québec the highest.

The only "competitive"[22] segments among the above are the short Moose Jaw–Regina portion of the route within Saskatchewan, between Wawa and Sault Ste. Marie, and Sudbury and Toronto. In Ontario, these were the segments with the *higher* fares per mile, 16.9¢ and 17.4¢ respectively.

**British Columbia**

In British Columbia, Greyhound's fares averaged about 12-1/2¢ per mile. The fares do not vary, apart from a taper which produces fares as high as 14¢ per mile for short distances and as low as 12¢ per mile for longer distances.

Maverick Bus Lines service between Vancouver and Pemberton had fares of about 10¢ per mile, that is, $10 to Whistler, $12 to Pemberton. Vancouver Island Coach Lines has a tapered fare schedule that ranged from 15¢ to 16¢ per mile. Examples are shown in Table 4.

*Table 4*
*VANCOUVER ISLAND COACH LINES SAMPLE FARES*

| Route | Fare | Fare per mile |
|---|---|---|
| Victoria to Duncan | $6.40 | 16.0¢ |
| Victoria to Nanaimo | 11.20 | 15.5 |
| Victoria to Port Alberni | 19.20 | 15.7 |
| Victoria to Campbell River | 25.60 | 15.4 |

## Alberta

In Alberta, as in British Columbia, Greyhound dominates the bus industry, and fares generally are for Greyhound routes. The fare level in Alberta was about 14¢ per mile, with some taper providing a range from as low as 13¢ to as high as 15¢ for shorter distances. Because the maximum rate per mile is regulated, rates are generally consistent throughout the province, north and south.

There are two exceptions. Greyhound's through fare between Calgary and Edmonton was $22, or 11.7¢ per mile, and its fare from Edmonton to Fort McMurray was $30, or 10.9¢ per mile. These are the two routes over which Red Arrow Deluxe Service also operates, but at higher fares. This suggests that to compete, Greyhound has had to maintain its fares at a lower level than elsewhere in Alberta, where competition is absent.

## Saskatchewan

The average fare level in Saskatchewan was 12¢ per mile, with no apparent taper. Most of the fares are for STC routes. On routes served exclusively by Greyhound, rates seem to be fractionally *higher*, about 12.3¢ per mile. (There was one anomalous situation noted where two different rates were published from Yorkton to Saskatoon, $25.30 (12.3¢/mile) applying to STC, and $27.00 (13.2¢/mile) applying to Greyhound; certainly this is not evidence of meeting "competition.")

## Manitoba

Apart from the through routes served by Greyhound, the scheduled bus service in Manitoba is provided by Grey Goose Bus Lines. Manitoba had about the same fare level as Saskatchewan, 12¢ per mile with very little taper.

There is an exception, the only example discovered of a common fare applicable to a group of points in a geographic area, a common practice in freight pricing. From Winnipeg there was a fare of $69.75 applying to a number of communities in the far North, between the junction at Ponton and points beyond, such as Thompson and Lynn Lake. The resulting fares to the less distant points were higher than the 12¢ norm for the province, 14.6¢ to Thompson, with Ponton the highest at 18.2¢ per mile.

## Ontario

The fare structure in Ontario is more diverse than in the other provinces and offers additional insight into what increased competition might bring.

There are three major bus lines operating in northern Ontario. Greyhound and Grey Goose have overlapping routes, but fares do not appear to be affected by this. For the through routes, regardless of whether one or both carriers are involved, the fares have some taper, and ranged between 14-1/2¢ and 16-1/2¢ per mile. The third carrier is the provincially owned Ontario Northland whose fares were higher, averaging 17-1/2¢ to 18¢ per mile with no taper.

Greyhound's shorter-distance local fares were higher, given the taper. North Bay to Sudbury, 130 miles, was 16.4¢ per mile, Sudbury to Espanola, 70 miles, was 17.3¢ per mile. These fares can be contrasted with those charged by A.J. Bus Lines, a charter line operating a scheduled service between Espanola and communities on Manitoulin Island. The fare to Little Current was $4.25 or 12.9¢ per mile.

The fares between northern and southern Ontario were higher than those in either the north or the south. The fare on the Greyhound express service between Sudbury and Toronto, at 17.5¢ per mile, was higher than on any other segment of its trans-Canada route, yet it is this route that has one of the country's few instances of intra-modal bus competition.

Gray Coach Lines had one express bus per day on this route which operates between the same terminals at the same price as Greyhound. Regulations allow for different fares, but the transparency of tariffs probably renders this impractical as a long-term competitive tool. The two carriers seemed to compete, but senior managers expressed different views. Greyhound considers the Gray Coach service more complementary than competitive; Gray Coach considers itself in competition with Greyhound, but not on the basis of fares. Gray Coach also provided the once a day local service over this route. As well, it operated the only through service between North Bay and Toronto, at a fare of 20.4¢ per mile.

Gray Coach operated other routes northwest of Toronto, at fares ranging from 20.8¢ to 23.4¢ per mile, some of them in competition with Penetang Midland Coach Lines at the same fares. Serving different routes in the same region is Chatham Coach Lines/Cha-Co Trails, whose fares were similar, 22.5¢ to 23.5¢ per mile. Can-Ar Coach Service had lower fares on its route from Southampton to Toronto — 19¢ per mile.

Routes in southern Ontario have varying fare levels, with no apparent pattern. Greyhound's fares and those of the smaller lines ranged from 11.7¢ through 23¢ per mile, with no apparent pattern to distinguish Greyhound's from the others.

Apart from a few local scheduled routes served by regional charter lines, routes east of Toronto are served exclusively by Voyageur Colonial. The biggest market in eastern Ontario is the Toronto–Ottawa–Montreal corridor. Voyageur's fares are lower per mile in this corridor (where there is competition from subsidized rail services) than on the lower density routes:

- For the 125 mile Ottawa–Montreal route the fare was 16.1¢ per mile; but 18.7¢ for the 133 mile Pembroke–North Bay route.
- Montreal to Toronto is 342 miles[23] and the fare was 15.7¢ per mile; by contrast, Montreal to North Bay is 336 miles and the fare 18.0¢ per mile.
- Some local intermediate portions of the corridor routes had fares as high as 21¢ per mile.

The lower fares on the corridor express services probably are the result of competition from VIA Rail. Nevertheless, both the higher and lower scales of Voyageur's fares fall within the range of average fares in southern Ontario.

As discussed earlier, there appears to be a degree of non-compliance with Ontario's regulations requiring filing and approval of fares. There is evidence of reduced fares being implemented without being filed until later, or at all.

There are frequent cases in Ontario of fare changes and special fares as marketing tools. An example was Greyhound's introduction last winter of advance purchase fares on a number of routes at greatly reduced levels, apparently with disappointing results. There are a number of special discounts available from most carriers. These include discounts for specific groups, such as seniors and students, and special fares for such things as same day return. Such discounts appear to be more numerous and larger on routes where VIA Rail offers discount fares.

### Quebec

In Quebec, fares were higher than in Ontario, but were generally consistent within the province. For the shortest trips, under 100 miles, the fares averaged about 22¢ per mile, and beyond that, with no apparent further taper, a little over 18¢. Fares for travel within the Gaspé, and to a lesser extent to and from the Gaspé, were lower than fares elsewhere, as low as 15.8¢ per mile between the communities of Rivière-du-Loup and Gaspé, a distance of 312 miles; and 16.5¢ between Quebec City and Gaspé, 427 miles.

### New Brunswick and Prince Edward Island

In New Brunswick SMT operates all scheduled bus transportation services. Fares averaged about 18¢ per mile, with a taper that caused a range from 25¢ for 34 miles, to 17¢ for 300 miles.

Interprovincial fares from Prince Edward Island were the sum of the fare of $15.25 from Charlottetown to Amherst (including the ferry), and the appropriate fares beyond.

### Nova Scotia

In Nova Scotia it appears to be a little more difficult (or at least slower) to get a fare increase approved by the regulatory agency. Any application for a fare increase results automatically in a public hearing. That may be a contributing factor to a level of fares in Nova Scotia which are three or four cents per mile lower than those in New Brunswick, and lower than any other province east of Manitoba.

There is a taper, but less than in the past, and Acadian Lines plans to remove it. The fares were calculated at 9¢ per kilometre up to 250 km, and 8¢ per km beyond. (Acadian is one carrier which does use kilometres internally.) The result was a schedule of fares ranging from 14¢ per mile for the 255 miles from Halifax to Sydney, to 14.5¢ for distances less than 154 miles (250 kilometres).

MacKenzie Bus Lines operated the service on the south shore between Halifax and Yarmouth at fares lower than Acadian, tapering from 10.9¢ per mile for the 220 miles from Halifax to Yarmouth, to 13.4¢ for the 67 miles to Lunenburg. MacKenzie's fare to Yarmouth was $24, and Acadian had a competitive fare of $25, or 11.4¢ per mile. This compares favourably to the $31 the fare would have been if calculated the same way as the others.

### Newfoundland

CN Roadcruiser's fares are subject to approval by the federal regulatory agency, that is, the National Transportation Agency. The fare schedule in effect in 1990 was a tapered scale ranging from 12¢ per mile for the 562-mile trip from St. John's to Port aux Basques, to 20.8¢ for the short 60-mile trip between St. John's and Windsor/Grand Falls. These fares are among the lowest in the country, without any competition existing in Roadcruiser's market.

### Summary

The provincial regulatory regimes generally lead to quite consistent fares, generally on a constant per passenger-mile basis, irrespective of route type, load factor and trip distance. Notable exceptions include Greyhound's Calgary–Edmonton and Edmonton–Ft McMurray fares (where there is competition from Red Arrow), and within Ontario where there is a substantial range. Quebec fares are generally the highest.

Two of the three provinces with the lowest fare levels in the country are Saskatchewan and Newfoundland. In both of these provinces, the dominant carrier is publicly owned, STC by Saskatchewan and Roadcruiser by the federal Crown corporation Canadian National. Both carriers have operating losses.

# 6. COMPETITION

This section first presents a brief description of the bus industry's competitive environment and the extent of competition from other modes. Then, competition (or its absence) between bus carriers in their regulated environment is discussed.

## 6.1 INTERMODAL

According to the most recent available data,[24] in 1988, about 37 percent of domestic intercity journeys, using scheduled public transport, were made by bus. The average journey by all public modes was about 600 kilometres; by bus it was 155 kilometres. It follows that the bus mode accounts for only about 10 percent of passenger-kilometres.

The bus is perceived as "the poor person's" mode of travel. It is traditionally the lowest-priced mode. The typical bus passengers are perceived, not as those who choose not to drive their own cars on short to intermediate trips, but those who cannot drive because of age or disability or do not have cars to drive (working poor, unemployed, students).

Demand for intercity scheduled bus travel is considered to be countercyclical, or at least does not suffer as badly in poor economic times as do the other modes. It is a more attractive alternative to those whose economic value of time is low. During recessionary times, as the lowest cost alternative, it attracts new business from the automobile and higher-cost public modes; during prosperous times, it loses passengers to the more expensive public modes and to the private automobile.

### Air

Air traditionally has not been seen as competitive with bus in Canada. Air fares were usually seen as being out of reach for the typical bus passenger. As well, the time saved by air travel, that mode's chief advantage, probably does not have as high a value to the average bus traveller. There have been airline deep-discount fares and seat sales from time to time which have come close to, and occasionally met, bus fares over longer distances. These fares, however, have required advance booking and advance ticket purchase. Most bus travellers are not accustomed to purchasing tickets in advance, and the finances of many may be such that they cannot. Further, most of the rural communities and small towns served by bus do not have air service or even an airport.

This does not mean there is *no* competition between the air and bus modes. There certainly are travellers who prefer the faster air mode but because of their high sensitivity to price opt for the bus. Students are an example. When sufficiently low air fares are available, these bus passengers will accept the conditions and travel by air. In the United States where air fares are generally lower than in Canada, this competition was sufficient to have made a major contribution to the growing losses suffered by the large long-distance bus carriers. Since 1990, air seems to have had an increasing impact on longer-distance revenues of Canadian bus carriers. As of 1992, longer-distance air discount fares regularly fall below undiscounted bus fares.

During off-peak travel periods before and after the Christmas-New Year period of the winter of 1991, Greyhound introduced large discounts on a few selected routes (as much as 70 percent in some cases). These were advanced purchase excursion fares, restricted to certain days of the week, and specified (off-peak) departures. Furthermore, only a limited number of these excursion passengers could be carried on a single departure, and there was no refund. According to Greyhound, they met with very little success, largely because most bus travellers will not purchase tickets in advance. It may also indicate that they do not travel for the sake of travelling, so do not travel more because of a seat sale; in other words, it might suggest that demand of bus customers for travel, though not necessarily by bus, is price inelastic. Finally, the season might have excluded such price-sensitive segments of the market as students.

**Rail**

Rail travel traditionally has been more elegant, more comfortable, but higher priced than bus; more time consuming but more comfortable and less expensive than air. For some years, however, VIA Rail has implemented marketing strategies aimed at increasing volume and market share. They have been aimed at the air mode in the shorter distance Toronto–Ottawa–Montreal market, with emphasis on faster schedules, more convenience and better service (VIA 1). As well, the strategies have targeted the high-volume bus mode and the private car with discount fares.

As other VIA Rail services have been discontinued in recent years, the emphasis of their competition with the bus carriers has been in the Quebec City to Windsor corridor. The most affected carrier is Voyageur Colonial (VCL), which has VIA competition virtually throughout its system. According to its President, VCL loses a considerable amount of traffic to VIA. He expresses anger and frustration that VIA is able to compete effectively with fares sometimes lower than the bus fares, while it recovers only a small portion of its costs. If it were not government owned and financed, he says, it would have to have a commercially sound fare structure. In that case, VIA would not be such a competitive threat and VCL's viability would not be threatened. VCL fares on the services with direct competition from VIA are lower per kilometre than elsewhere, no doubt a result of that competition, but made possible because of the higher traffic volume.

VIA probably does not greatly affect the traffic volumes of bus carriers elsewhere in the country, particularly since the 1990 cuts. Two of the services cut were in Nova Scotia, and it is not clear what effect, if any, was felt by the bus mode.

VIA operated services between Halifax and Yarmouth, via the Annapolis Valley, and between Halifax and Sydney on Cape Breton Island. Both of these services were discontinued on January 15, 1990. Acadian Lines estimated that VIA had between 15 and 20 percent of the public travel market on those routes. Data have been provided by Acadian which indicate that the number of passengers carried on those routes in the last six months of 1990, after VIA discontinued the service, were three to four percent *lower* than for the same period in 1989, before the VIA cuts. (The full year's data were not used because they are distorted by an eight-week strike at Acadian during the spring of 1989.)

Discussion with Acadian's President produced two possible explanations. Some VIA passengers, who had been using connecting bus service, or bus service for one half of a round trip, might not be travelling in the absence of rail service. In other words, there were VIA passengers for whom Acadian provided feeder service. Alternatively, gains from VIA might have been masked by overall demand effects. Acadian's passenger business has been declining for years, as is true elsewhere in the industry. Acadian might have gained traffic from the VIA cuts, but the net year-to-year change is still negative. In other words, had VIA continued its service, Acadian's volume might have declined by considerably more than three or four percent. Fare increases of 8.25 percent on August 1989, 9 percent on February 1 1990, and 9.5 percent on September 1 1990 are also relevant.

## 6.2 INTRA-MODAL

The regulatory environment in which most of the Canadian bus industry operates, effectively discourages competition among carriers on the same routes. There are, of course, important exceptions. New Brunswick and Prince Edward Island removed the major legal barriers to market entry in 1987. Beginning in 1977, the Ontario environment apparently became more accepting of competition. In Alberta there is a noteworthy instance of two competitive services.

These exceptions are discussed below. There are a number of other instances where, technically at least, "competitive" bus service exists, but these are of little consequence and not discussed here in detail. They are mostly overlaps in the routes of carriers, such as Greyhound's trans-Canada routes and the intra-provincial services of Saskatchewan Transportation Company.

### New Brunswick and Prince Edward Island

New Brunswick and Prince Edward Island removed a major hurdle to competitive bus service January 1, 1988, by no longer requiring applicants for operating authority to prove "public convenience and necessity." Instead the burden passed to those objecting to an application, who now must prove the proposed service will be detrimental to the public interest.

The new rules do not appear to have attracted many new entrants into the market. In New Brunswick there are three new licences for very restricted scheduled services; at least one is a new airport service. Ten new charter licences have been issued, but most of these are established operators expanding their territory throughout the province.

These provinces do not have large population centres and SMT (Eastern) appears to have an efficient and reasonably priced service in most areas. There has been no apparent attempt to challenge that monopoly in the scheduled market. On the other hand, new charter operators, and to a greater extent existing charter operators with increased territory, have resulted in a significant decline in SMT's charter business. Three years ago, SMT had 37 buses assigned to charter service; that number has been reduced to 10.

### Ontario

In 1977, for the first time, the Government of Ontario authorized a bus carrier to operate on routes in Ontario over which bus service already existed.

Greyhound's trans-Canada service from the west coast extended to Toronto, but on the last leg of the route, between Sudbury and Toronto, it was Gray Coach Lines which had the authority to operate, not Greyhound. By agreement, Gray Coach operated Greyhound's buses over that route. Also, Greyhound operated service from Toronto to connect with the U.S. bus networks through Detroit, but not through Buffalo. Again, it was Gray Coach that had exclusive authority to operate between Toronto and Buffalo.

Greyhound appealed to the Government of Ontario for authority to operate between Sudbury and Toronto, and between Toronto and Buffalo. This was granted by a Cabinet Order in 1977, but with a "closed-door" restriction, that is, no rights to carry passengers between intermediate points.

Greyhound operates five daily runs between Sudbury and Toronto. Four of these runs are part of its trans-Canada system. All are express (through) services. As discussed above, Gray Coach operated, and now the Crown-owned Ontario Northland operates, one express service a day in addition to a local service.

Senior representatives of the two carriers have expressed different interpretations of the Greyhound-Gray Coach relationship on this route. Greyhound considers the Gray Coach service as complementary, not competitive. Gray Coach sees it as strictly competitive, but not on the basis of price. The Gray Coach express service and one of Greyhound's buses left Toronto at what could be perceived to be competitive times, between 4:00 and 6:00 p.m. Apparently there have been a number of changes made in these departure times. According to Gray Coach, this was done to gain competitive advantage.

When, as discussed earlier, Greyhound introduced experimental advance-booking fare reductions, ranging to as much as 70 percent, the experiment was only carried out on a few selected routes, including that between

Toronto and Sudbury (Toronto–London where it competes with VIA Rail and Thunder Bay–Winnipeg were two others). According to Greyhound, the purpose was to determine whether low fares would significantly increase volumes. The Greyhound spokesman said that Gray Coach was advised in advance of these fares being introduced on the Toronto–Sudbury route. Gray Coach met the reduced fares, and advertised them with posters in the terminals. It appears, however, that Gray Coach failed to file or was exempted from filing the appropriate tariffs with Ontario's Carrier Licensing Office, as regulations normally require.

Price competition in public passenger transportation is difficult regardless of what regulations exist. A fare reduction must be publicized to have the desired effect. Even if the carrier neglects to file the tariff change with the authorities as required, the reduction will be known to the (presumably watchful) competitor rather quickly. A spokesman for Gray Coach Lines expressed the view that price competition does not make sense, because everybody loses. He stated further that Gray Coach meets any other carrier's fare reduction, but will not set fares lower than competitors — it will not get into a price war. In his opinion there is not really any price competition between bus carriers, but fare reductions will be introduced to increase market.

Gray Coach also considers itself in competition for through traffic between Toronto and Buffalo. Gray Coach had pool agreements with Greyhound (U.S.) to operate each other's buses, allowing the convenience of through coach service between Toronto and major U.S. points, with only driver changes. With Greyhound (U.S.) on a complicated strike, Gray Coach did not want to operate its buses, so the agreement is no longer in force. The spokesman said that recently Gray Coach has entered into equivalent agreements with other U.S. carriers, and now "beats" Greyhound of Canada's connections to New York and most other major U.S. destinations.

With Gray Coach's sale of certain routes to the provincial Crown corporation, Ontario Northland Transportation Commission (ONTC), competition could change. The routes involved extend north from Toronto to Barrie, Penetang and Midland, Owen Sound via Collingwood, North Bay and Sudbury. Not included are its other two routes to Owen Sound, and its southern routes between Toronto and Niagara Falls, Buffalo, Cambridge, Guelph and Kitchener.

Gray Coach has been operating between Toronto and Owen Sound via Guelph and Highway 6, and via Brampton and Highway 10 through Orangeville. It is the only carrier on those routes. It also had authority to operate to Owen Sound via Barrie and Highway 26 through Collingwood, and through Barrie to Midland and Penetang. Penetang-Midland Coach Lines (PMCL) also has authority over these two routes. Until recently, neither carrier has been operating the full routes. Gray Coach has operated between Toronto and Barrie; PMCL has not. PMCL has operated north of Barrie; Gray Coach has not. However, PMCL has just introduced a service between Toronto and Barrie.

Two of the parties in opposition to Gray's sale of licences to Ontario Northland deserve some attention in the context of this discussion of intramodal competition. Greyhound had Gray Coach operating some "complementary" service on its Toronto–Sudbury route, probably causing only minimal damage. With approval of this sale to ONTC, it could be faced with stronger and more frequent complementary service from a government-financed carrier. But, perhaps as a result of some understanding, Greyhound has withdrawn its opposition.

The remaining opposing carrier, PMCL, operated in a territory where it enjoyed a monopoly position as long as Gray Coach or its successor chose not to avail itself of its operating authorities. Now it will face a competitor financed by the provincial government.

There is other scattered and restrained competition in Ontario, particularly in the densely populated southwest.

Both Greyhound and Gray Coach operate between Toronto and Hamilton, a short distance, but in a densely populated area. The Queen Elizabeth Way route to St. Catharines, Niagara Falls and Fort Erie (and Buffalo) is served by Canada Coach Lines out of Hamilton, and by Gray Coach out of Toronto. (As already mentioned Greyhound operates a "closed door" service between Toronto and Buffalo.) Also in the Niagara Peninsula but over different highways, Farr's Coach Lines provides service between Port Colborne and St. Catharines, and between Hamilton and Dunnville.

Greyhound has a monopoly on the through service between Toronto and Windsor, between Buffalo and London, and between London and Windsor via Route 3 along Lake Erie, although there is some overlap by other carriers between some of the intermediate points. For example, Chatham Coach Lines operates tri-weekly local service between Windsor and Leamington, but not at the same times as Greyhound.

There are a number of situations where licences have been granted to different carriers to operate distinct services, but their routes overlap for relatively short distances. On some of those overlapping segments there might be limited competition although, as far as can be determined, the fares are the same.

There is an example in the Bruce Peninsula. Cha-Co Trails (a subsidiary of Chatham Coach Lines) has service between London and Owen Sound. Can-Ar Coach Service operates between Toronto and Southampton. These routes overlap along Highway 21, for the 30 miles between Kincardine and Southampton. Both operate in the morning southbound, one leaving Southampton at 6:30, the other at 9:00; and at night northbound, leaving Kincardine at 8:50 and 9:20 respectively. They are probably more complementary than competitive in this rather small local market, and the schedule times are doubtless set to accommodate the larger end points of the routes.

The 50-mile Toronto to Orangeville segment of this Can-Ar route also overlaps with the Gray Coach service to Owen Sound. The daily Can-Ar bus operates at about the same time as one of the two daily Gray Coach buses. The carriers depart from Toronto at 5:30 and 6:00 p.m. respectively, and from Orangeville at 9:45 and 9:15 a.m. The similar arrival and departure times at Toronto probably are set to meet the demands of the two individual markets, rather than to gain competitive advantage on the Orangeville segment.

In addition to the above, industry representatives have pointed out that Ontario's GO Transit operates buses and trains over the routes of intercity carriers within a substantial radius of Toronto. This constitutes competition with respect to a portion of the carriers' potential riders. Also, competition in a restricted intermodal context has been provided by bus service from southern Ontario communities to the U.S. and Buffalo airport,[25] and there have been reports of scheduled services operating between major Ontario centres without operating authority.

### Alberta

Greyhound has competition in Alberta from Red Arrow Deluxe Service of Edmonton. Red Arrow made a case before the Motor Transport Board in Alberta that there was a distinct unserved market for a "deluxe" express bus service between Edmonton and Calgary, and between Edmonton and Fort McMurray. It is the equivalent of the air industry's "business class." Buses have 10 rows of seats with a two by one configuration, instead of Greyhound's standard 12 rows, two by two. The result is 30 seats per bus instead of 47. Red Arrow's service has washrooms, video entertainment and earphones, like Greyhound's, but also has facilities to provide light refreshments (tea, coffee, hot chocolate, cookies, cheese and crackers). Alcoholic beverages are not available. Red Arrow also cooperates intermodally with VIA Rail, including bus-rail through fares.

Red Arrow fares were higher than Greyhound's — in 1990, $26 versus $22, Edmonton to Calgary; $34 versus $30, Edmonton to Fort McMurray. On the Calgary route, Red Arrow appears to have load factors similar to those of Greyhound, and a little over 15 percent market share. On the Fort McMurray route, it seems to have load factors a little higher than Greyhound's, and about 50 percent of the market.

These routes are probably two of Greyhound's most profitable; certainly the high-density Edmonton–Calgary route must be. However, Greyhound's fares on these routes are generally lower than elsewhere. Between Edmonton and Calgary, the through express rate in 1990 was equivalent to about 11.6¢ per mile; on intermediate segments it was about 13.7¢. This appears to be the only Greyhound route, at least in Alberta, with a significantly lower rate per mile for the through service, no doubt the result of the Red Arrow competition.

As already described, Big Rock Bus Lines provides service between Calgary and Okotoks, High River and Turner Valley. Although Greyhound may serve the same market with its Calgary–Lethbridge local service, this is a commuter market and, thus, not a competitive intercity service in the context of the Commission's work.

### Summary

Throughout most of Canada there is substantial competition in the charter bus industry, and this has been growing in recent years. Competition in scheduled services is primarily intermodal and limited to a very small proportion of the routes served by the industry. With very few exceptions, where it does occur the competition is either between services approved as different in either quality or route, or price competition is absent.

## 7. CARRIER COST STRUCTURES

To allow comparison and analysis of different bus services, operated by different carriers, a common and simple method to estimate costs was designed. This costing was based on cost and statistical data made available on a confidential basis by various bus operators. The data were combined to present a reasonable approximation of average costs for segments of the industry, while not compromising the confidentiality of any single contributor of data.

The cost estimates were not simple averages. Rather they were the product of analysis of the costs of the various carriers and the differences among them, to achieve unit costs which appeared to represent a typical or normal level of cost. Two costing formulae were developed — one for use with services of small carriers, the other for major carriers. These formulae were computed for the use of the Commission's research staff to analyze fares and profitability of specific typical intercity scheduled bus services.

The measure used by the bus industry for cost analysis is the bus-mile. It was felt that comparisons would be a little more meaningful if other measures were used as well. To make the comparisons required by the Commission, costs were attributed according to more than a single per bus-mile variable. Some of the income statement cost categories were attributed to bus-miles. Others were attributed to bus-hours to reflect the different time-to-distance ratios of some services, and per passenger to reflect costs that are variable with the volume of traffic (number of passengers), but not with distance travelled.

The depreciation cost of buses is included in the bus hour cost. It is a common cost for the industry based on an average capital cost and age of a standard bus in intercity service. As well, cost of capital is included, using the 10 percent real rate of return assumed as appropriate for the overall transportation industry, for the purposes of the Commission's work.

The cost per passenger includes a cost for terminals, but this is not ownership cost. Instead, an amount representing terminal charges or rent is used. Some carriers own all the terminals they use; some do not own any. Most of the large carriers own some terminals and pay charges or rent for the shared or exclusive use of others. At least one major carrier owns a terminal, which is treated as a distinct profit centre, with charges made to the bus operation for its use.

The unit cost reflecting bus time is calculated per scheduled bus-hour. This makes calculation of the cost for specific services easier, because the cost includes an idle or utilization factor. The analysis done for this paper indicates that there are between 3.5 and 5 buses owned for every one actually moving and carrying passengers on scheduled service at an average point in time. Overall, it is estimated that for every hour a bus is moving with passengers, it has spent or will spend almost three and a half hours in terminals, in a garage or being available for service. This reflects the high degree of peaking in the transportation industry, and the practice in the bus mode of providing extras or overloads — supplying as many buses as necessary to accommodate all passengers who wish to use the service. This factor was calculated using bus inventory, bus-miles and an estimate of average schedule speed of 40 or 50 miles per hour. It provides a rough approximation, but data required to make more dependable estimates were not available.

Data were received from a variety of carriers, some large, some small, some operating in major population centres, some in remote areas. Some carriers operated primarily scheduled intercity services, and some had mainly charter operations. Although income statement data are difficult to compare, total costs were estimated for each of eight carriers. Total operating cost ranged from just over $2 per bus-mile to just over $4, but there is no clear pattern for carriers' relative positions on the range. From lowest cost to highest cost, they rank as follows:

1. small, primarily charter
2. medium-size regional
3. small/medium-size regional
4. large
5. medium-size regional

6. large

7. medium-size regional

8. small, remote, mostly packages

Cost structures of the small carriers do not differ as much as the above list might suggest. Generally these carriers are small operations with only a few buses, and a high proportion of charter business. Utilization of the buses and facilities and sometimes even drivers, not to mention trip distances, can cause radical cost-per- mile variance, because the numbers are relatively small.

Two elements which will affect the cost structures of carriers of all sizes are the size and treatment of their debt and the rates of pay for drivers. (These are factors that were not distinguished in the cost model.) Usually small carriers enjoy an advantage over large carriers in both these respects. Two of the largest carriers in Canada, however, have very different costs, caused by these two factors together with a difference of about 30 percent in average bus use.

The publicly owned bus carriers in Canada include Newfoundland's Roadcruiser, owned and operated by Canadian National, a federal Crown corporation; Saskatchewan Transportation Company and Ontario Northland Transportation, both provincial Crown corporations; and Canada Coach Lines, municipally owned and operated. Some data have been made available for the federal carrier, one of the provincials and the municipal carrier. The latter seems to be in line with total costs per mile of other carriers of its size and scope; the provincial and federal Crown corporations rank at the high end of the cost-per-bus-mile range.

Some statistical analysis would be useful here, but the data received from the various carriers are not sufficiently detailed or consistent. As well, such analysis would risk violation of the confidentiality agreed upon with the individual carriers.

## 8. CROSS SUBSIDIZATION[26]

Bus industry representatives and several carrier officials, in particular the presidents of two major intercity bus companies, insist that, without the present system of monopolies maintained by regulation, many small communities would lose their bus service. In fact, this is the predominant defence of the status quo. It is asserted that regular service to small communities at restrained prices is only possible because carriers are required or expected to provide it as a condition of authorities to operate profitable unit toll routes and charter services. The president of one major carrier has stated that the day after deregulation he will withdraw service from more than 100 communities.[27]

The costing system for intercity bus was designed to enable sharp focus on the question of cross subsidization. In particular, this was the principal reason for inclusion of the bus-hours (small community or local service is characterized by many stops and thus slow average speed) and the per passenger (local trips are usually shorter) output variables, in addition to the usual passenger-kilometres or bus-kilometres measure of output. This allowed an important degree of specificity in terms of isolation of cost levels associated with local versus express interurban services.

Calculation of the cost of a service, using these unit costs, required the appropriate operational output units: bus-miles, bus-hours and number of passengers. Bus-miles and bus-hours were estimated using the schedules contained in the *Official Canadian Bus Guide*. To analyze profitability and examine the extent of cross subsidization, the break-even load factors were compared to actual or probable carryings. Detailed passenger carryings were only available from one major carrier; load factors (percentages of seats filled), in varying detail, were provided by a few other carriers. This, together with the uncertain accuracy of these data, made it necessary to analyze a broad range of services, without knowing relevant numbers of passengers. The method adopted was to use the appropriate bus fares[28] to calculate its break-even passenger load for each specific service in the sample; that is, the number of passengers, at the given fare, required to cover the cost of providing the service — below which the service loses money, above which it earns a profit.[29]

This introduced another variable, segments. On a local bus service, passengers get on and off at intermediate points along the route. In accordance with the principles of the costing methodology being used, each time a passenger boards the bus, the cost of a passenger is incurred.[30] For some local services with shorter average trip distances, the per passenger element (at break-even traffic volume) exceeded 60% of total cost, with 25% attributable to bus-kilometres and 15% to bus-hours. On the other hand, for a longer distance express service, over 60% of cost at break-even load is attributable to the bus-kilometres element and less than 10% to the per passenger element.

A few examples for actual routes and averaged costs are offered in Table 5.

*Table 5*
*EXAMPLES OF ROUTES AND AVERAGED MAJOR CARRIER COSTS*

| Route description | Service type | Break-even load factor (as a percentage) |
|---|---|---|
| Major intercity | Express | 53 |
| | Semi-express | 59 |
| | Local | 151 |
| Medium to large city | Express | 32 |
| Small to medium city | Express | 36 |
| Large city to rural | Local | 131 |
| Medium to large city | Local | 39 |

The figures given in Table 5 for break-even load factor represent the average seat occupancy that would be necessary were the service in question to recover the generalized level of cost (including a reasonable economic return on capital invested) for a major carrier as has been described. The service conditions were selected from some 50 examples to which the cost models were applied. The examples illustrated in Table 5 suggest the potential diversity of cost recovery on various routes.

Load factors of 151% and 131% are not possible. There is no chance that services as described could recover cost (unless there was a lot of profitable freight, which was not the case for any of the examples). In fact, rural services or, worse, local services connecting rural areas to a city can never achieve high average loads; 50% would be very optimistic, 20% to 30% generally realistic. On the other hand, major intercity operations regularly exceed an average of 60%, indicating that some of the above are very profitable (in isolation).

The results of the cost analysis using actual values, when compared to route and service-specific loadings provided by the carriers, demonstrated cross subsidization even more clearly. The most profitable express run investigated earned revenue which exceeded by more than 100% its computed fully allocated cost (including return on investment). Interurban express services whose revenues cover total cost plus 50% are the rule. At the other end of the scale are local services whose revenues cover as little as 15% of fully allocated cost. Profitable locals are the exceptions, and cost-recovery levels of only 25% are typical for local routes which parallel express service between major urban centres provided by express operations. At the intermediate level, mixed services (where interurban passengers are carried but stops at small communities are also made), and longer-distance interprovincial services, are (for the most part) comfortably profitable.

The very poor results for local services actually overstate real losses in most cases but it is not known by how much. Not considered are revenues from parcels or the profits from possibly lengthy journeys that start and/or end with a short leg on a local service. None of the carriers consulted had accounting systems from which the parcel freight and connecting stage joint products for local services could be reliably attributed to those individual local services. It is clear, however, that parcels are generally a very important source of revenue for services to remote areas, particularly in the North. Nearer urban areas, courier services effectively compete for the parcel market. Also, there are long- or medium-length journeys which might not be made by bus if there is no service connecting with origins or destinations on local routes.

It is also relevant to note that the losses for local services, and hence the extent of cross subsidization, are also the result of the fare policies discussed above. Fares per kilometre for short-distance local services are rarely much above, and are sometimes below, fares for high-density interurban travel. Relaxation of the regulations that protect monopolies on profitable routes would, presumably, be accompanied by relaxation of the restraints on local fares. Presuming a relatively inelastic demand,[31] fare increases would make some local services viable.

There are also other possibilities for economical service to small communities that would leave them served by other than full-size coaches with washrooms. The market would be opened to mini bus operations, more use of school buses on short scheduled runs, and a variety of part-time ventures into local scheduled service. Inevitably, there even might be communities not now served by scheduled service that would gain it. Notwithstanding all of these possibilities, some communities would lose service.

Overall, examination of cross subsidization of bus routes in Canada suggests that the most vulnerable services (the highest recipients of cross subsidy with the lowest prospect of viability through parcels or fare increases) are those serving small communities between major centres where the major centres are served by interurban express operations. This is most prevalent in the relatively urbanized south of Canada.

## 9. EFFECTS OF ECONOMIC REGULATION IN OTHER COUNTRIES[32]

### 9.1 REGULATORY REFORM

Studies of the industry's structure prepared by the U.S. Department of Transportation and the academic community supported the total deregulation of the intercity bus industry in that country. Academic research in the United States indicated there were no significant economies of scale in bus operations. The earlier belief that the industry was a natural monopoly was set aside. This encouraged policy makers to view competition as the means of securing the most efficient and socially acceptable intercity bus transportation system, and led to the deregulation of interstate bus services, with some states following suit.

British research also supported a reduction in economic regulation. In most public bus operations, the cost of providing a seat-mile of service falls with the capacity of the bus in use. There are thus economies of scale with larger vehicles. Such economies do not, however, constitute a barrier to market entry since buses are readily purchased or transferred from other services. Thus, while certain types of scale economies exist, they do not present restrictions on free entry or exit from the market. The British evidence indicated that, with suitable policy measures in place to control sunk costs under private control (terminals, reservation systems and so on), liberalization of pricing and entry met the requirements of maximizing efficiency and social welfare in the largely contestable intercity bus market. Britain deregulated interurban bus services, and later privatized its dominant Crown-owned national bus carrier.

As of 1992, we have a decade of experience with substantially reduced economic regulation in both the United States and the United Kingdom.

Although research in both the United States and Britain was supportive of total deregulation in both nations, the final legislation — though substantial in terms of reform — fell short of total deregulation. The British approach went further than that of the U.S., particularly with regard to express bus services.

**United States**

The 1982 U.S. legislation was restricted to interstate services and left in place:

- the requirement that new service applicants apply to, and be certified by, the Interstate Commerce Commission (ICC);
- antitrust immunity for the bus industry to discuss general and promotional fare changes; and
- ICC authority to regulate collective rate making.

Interviews with officials of the Congressional Research Service indicate that ICC decisions have pre-empted overwhelmingly state decisions in favour of carrier requests for abandonments and higher fares. This ICC policy has greatly weakened state regulation of intercity bus service and fares. Also since deregulation, the ICC has approved almost every application for new service authority, causing some to question the ICC's approval standards.

Unlike the case of airline deregulation, the U.S. Congress did not (at that time) build subsidy protection for small communities into the *Bus Regulatory Reform Act, 1982*, even though many expressed the fear that small and rural places, for which bus transportation is often the sole means of public intercity travel, would likely lose service. Instead, Congress took the view that small town protection is a state rather than a federal responsibility and elected to omit any form of special protection. Many favoured special protection and waited anxiously to assess the outcomes of reform. A decade later, however, in addition to state support of bus service to small communities, the *Federal Transit Act* provides subsidy funds for sharing the cost of intercity bus service assistance with the states.

**Britain**

The key feature of regulatory reform under the *British Motor Carriers Act* of 1980 relates to the road service licence. First, the legislation reclassified types of bus transport with a view to permitting greater product differentiation and diversity. Second, it makes it easier to obtain licences in general and limits the power of the commissioners to impose conditions. The exemption of express services from road service licensing is of considerable importance. The definition of such services under the Act is couched in terms of the distance every passenger travels — this must exceed 30 miles. In effect, long- and medium-distance intercity bus transportation is no longer subject to entry and exit regulation, although operators are still required to provide commissioners with details about their services. Local bus companies can offer virtually any bus service they deem profitable, subject only to a minimum of 42 days notice.[33]

To initiate an interurban bus service in Britain, candidate operators must only demonstrate that they are of good repute, of appropriate financial standing (a test of "fitness") and that they or their transport managers are professionally competent (a test of "ableness"). They must then register the service (a test of "willingness" to provide common carrier service and meet consequent obligations).

## 9.2 EVIDENCE — EFFECTS OF REDUCED REGULATION

### United States

Between November 1982 and May 1990, more than 7,400 applications were filed by new and existing firms for regular-route and charter-operating authority. A total of 5,600 of these were filed by new applicants. Approximately 13 percent of these applications sought regular-route authority.

The number of ICC-regulated bus companies rose from about 1,300 in 1980 to more than 3,600 in 1989. The majority of these operators provide charter, commuter and special-operations services. It would appear, therefore, that the post-deregulation industry will continue to be made up of a large number of independent operators.

This significant increase of U.S. operators masks considerable concentration in the regular-route "Class I" segment of the industry since deregulation. In March 1987, amid declining ridership and serious labour disputes, the Greyhound Corporation sold Greyhound Lines to GLI Holding Company. Later that year, citing Trailways' deteriorating financial condition, GLI petitioned the ICC for authority to purchase the operating rights and assets of

Trailways. In the spring of 1988, the ICC authorized GLI to purchase the interstate and intra-state operating rights and principal operating assets of Trailways Lines and Trailways' 50 percent interest in Continental Panhandle Lines.

From a competitive standpoint, the Greyhound-Trailways merger would appear threatening, since Greyhound now provides the vast majority of interstate regular-route service. In 1989, Greyhound accounted for some 85 percent of the revenues generated by the Class I intercity bus companies. Greyhound now provides the only intercity transportation in 9,000 of the approximately 9,500 markets it serves. Thus far, however, "anti-competitive" practices have not occurred. The legislation's entry provisions make it possible for other carriers to enter markets now served exclusively by Greyhound, and the essential contestability of the market appears to be preventing market abuse. As well, by ensuring that carriers can abandon unprofitable service, the ICC believes that the legislation encourages the introduction of new, innovative services (see "network" effects below).

Deregulation led the major operators to institute serious cost-cutting measures, including franchising, work-rule changes and the elimination of numerous routes they considered unprofitable. This action, along with other cost-cutting measures such as the renegotiation of wage contracts, helped reduce costs in the late 1980s but not by enough to reverse a trend of decreasing profits.

In more recent cost-cutting efforts, Greyhound Lines has shifted away from scheduled service to more profitable charter services; the company has given up certain low-density markets to smaller bus companies and, in a highly controversial step, increased the hiring of non-union labour. The latter, together with fundamental disagreements over major concessions sought by management, has precipitated a major strike. Labour is entrenched and as of the time of writing, the dispute shows no signs of easing.

Although deregulation led to serious cost cutting, including franchising, renegotiation of wage contracts, work-rule changes and the elimination of numerous unprofitable routes, this was not enough to reverse a trend of decreasing profits.

The intercity bus industry continues to provide extensive service throughout the United States, but there have been service reductions since 1982. According to the American Association of State Transportation and Highway Officials, about 4,000 co[illegible]ities lost intercity bus service between the start of regulatory reform [illegible]82 and the summer of 1988. Looking only federally, however, the ICC reports that, as of May 1990, it had received only 75 petitions to review applications to abandon interstate routes (nearly all of which were granted). The difference is in intra-state routes that are not federally controlled, and many of which remain regulated. The vast majority of the decline thus seems to be a continuation of past trends in the decline of the intra-state bus industry.

During the five years prior to deregulation, U.S. communities receiving bus service declined by 3.3 percent per year. For the three years following regulatory reform it was approximately 10 percent per year, a clear acceleration. Nonetheless, during the 1970s, when strict entry and exit regulations were in place, 1,800 communities lost bus interstate service. Moreover, many analysts believe that, without regulatory reform, more bus companies would have experienced bankruptcy, with even more rapid decline in the number of points served.

The Greyhound-Trailways merger led to a development that the authors of the 1982 Act hoped would occur, namely the commencement of rural feeder operations. Greyhound's "rural connection" which operates in a manner similar to the airlines hub-and-spoke system, uses vans to provide service in areas where there is insufficient demand to warrant the use of full-sized vehicles. These feeder lines, which are linked to communities served directly by Greyhound, are operated by independent entrepreneurs who act as agents for Greyhound and receive a portion of the fare. As noted earlier, similar operations are in evidence in Canada, particularly in the more northerly and remote regions.

### Britain

In Britain, the immediate effect of regulatory reform was a considerable reorganization and initial concentration within the express bus sector. Six major private companies combined to form a consortium, British Coachways, offering services from London to major destinations. The consortium was intended to provide a major competitor to the Crown-owned National Express, embracing the activities of the National Bus Company (in England and Wales) and the Scottish Bus Group.

After about four years of deregulation, however, the Crown carrier — National Express — had become, once more, a monopoly supplier on many routes where private operators had, in 1980-81, initially offered new service. Others now offer joint services with National Express. Further, British Coachways suffered from a succession of membership withdrawals and, by January 1982, had essentially collapsed.

Deregulation permitted new entry at fare levels potentially profitable to the private operators if load factors could be pushed up. Competition, however, brought a response from National Express (and from the Crown-owned railway which fought back with aggressive pricing policies of its own) both in terms of lower fares and improved service. The economies of scope enjoyed by National Express, and its aggressiveness, permitted recapture of the market from the independents on most routes. The threat of possible new entrants would appear, however, to have prevented National Express from raising fares once a monopoly position had been established.

National Express was privatized in 1987. Perhaps, had it been privatized seven years earlier, the deregulated industry might have developed differently.

As in the United States, studies in Britain found reduced numbers of areas with good access to interurban bus transportation after deregulation. A commission of inquiry, four years after regulatory reform, concluded that most of the areas that lost a service already had a low level of service, and most of the residents were unaffected by the loss because they made little use of the service anyway.[34]

These discontinued services between urban centres were not considered to have left a significant number of people without adequate transport. The results, for local services linking rural areas and small communities to the larger centres, were quite different. This was more of a privatization than a deregulation exercise. Contractual subsidies, administered by the local (shire) authorities, prevented virtually any loss of service attributable to bus deregulation or privatization. Considerable savings to the taxpayer were reported.

## Australia

Some Australian bus services have not been subject to economic regulation for many years. A 1955 court decision exempted Australian road transport from state economic regulation. The effect was, however, different from that of the analogous 1951 Canadian court (*Winner*) decision (see Appendix A). While all operations of Canadian carriers whose services extend beyond a single province are under federal jurisdiction, Australian interstate bus operators require state authorization to pick up and set down passengers whose travel is intra-state.

While interstate bus services are essentially unregulated, and charter licences are generally subject only to "fit and proper" (fitness) entry tests and to vehicle safety certification, intra-state scheduled bus services are tightly regulated. This notwithstanding, competing bus services are not precluded as they generally are in Canada. The regulators tend to discourage bus services that compete with, rather than feed, rail. Competition between bus carriers seems less of a concern. Varying degrees of competition are permitted on a variety of more major intra-state routes and on interstate routes where intra-state passengers are carried. Protection and cross subsidization of rural bus services do not seem to be a major rationale for Australian regulation.

Although there are still more companies in the deregulated interstate bus industry than there were in the early 1980s, the economic downturn and possibly the effect on some routes of airline deregulation, have reduced the industry through failures and mergers. Most non-urban bus companies are privately owned but in one state the government owns a fleet. Each state tends to have a small number of major intra-state operators plus a large number of smaller "one-route" operations that link particular regions with the state capital.

The intra-state carriers are strictly regulated as to approval to operate specific routes. Their fares are effectively controlled by the low (subsidized) rail fares. In two states, rail passenger transport is protected by regulating the bus companies to provide their service under contract to the railways. Fare levels do not show any sharp distinction between regulated/non-regulated routes or between routes on which competition does or does not exist.

Experimental entry liberalization for two corridors in New South Wales (regulation was reduced to approval of service changes and 14 days' notice of fare changes) led to lower fares, more service and a substantial capture of passengers from air, the automobile and (especially) rail. Terrain, size of market, and cost/price competition (particularly airlines) rather than regulation are the main influences on fare levels.

On the question of remote services, most communities in settled Australia are served daily by bus and/or train and the remote areas once, twice or three times a week. In rare cases community transit feeds the nearest regulated bus route.

As in Canada, there are a variety of local, regional and national carriers in Australia. In Western Australia the intra-state market is dominated by the bus operations of the state-owned railway; otherwise, privately owned carriers are the norm. In mid-1990 there were four or five firms that might be considered national in scope; now there are two, and these cooperate operationally with merger contemplated. In addition, there are local carriers affiliated with and serving as feeders to the dominant Greyhound/Pioneer.

### Other Countries

Although the most industrialized countries virtually all opted for bus regulation approximately 60 years ago, in many other nations unregulated private and very competitive bus industries emerged. These are nations with standards of living below Canada's, and where the demand for bus travel has shown, and for the most part still shows, healthy growth.

In some of these countries, bus was regulated and then deregulated. In others, it was never regulated. In still others, regulation was simply ignored by many bus operators. Whether regulated or unregulated, bus industries internationally are rarely without problems that seem to suggest changes to the regulatory regime.

General conclusions of those who have studied these bus industries include a tendency toward intense competition for passengers and the emergence of both high quality/price and low quality/price operations over the same routes. Independent minibuses appear on many shorter routes, and some powerful monopolies (with blatant abuses that would not be tolerated in

Canada) have developed. In general, the key to the prevention of abuses and achievement of a healthy competitive bus industry seems to have been strong competition legislation that is effectively enforced.

## 10. MONOPOLY POWER

The success of relaxed economic regulation of intercity busing will depend on the practicality of competitive challenges to the present regional monopolies. This could come from large bus operators expanding into each other's traditional markets. However, charter carriers and the small local operators that presently connect with the large monopoly carriers may be a more reliable long-term source for such competition.

The existing Canadian bus carriers did not develop in a competitive market, and some are large and powerful — particularly those owning key terminals. Greyhound controls a sophisticated customer information system that could readily be extended to reservations and ticketing.

Exchanging regulated bus monopolies for unregulated monopolies that set high fares would not be a step forward. Experience elsewhere, including in Britain, suggests that potential new competitors may require protection. A market open to entry will not function efficiently if carriers interested in expansion into an established bus company's market are intimidated by monopolizing conduct of the dominant carrier.

The topic of monopoly power is broader than the bus mode, but potential problems are particularly apparent in this context. For instance, enhanced general competition legislation could defend a competitor against pricing and other predatory practices used by a dominant carrier. The dominant carrier would sustain short-run losses in order to drive competition out of the market. Thus, it would seem prudent to strengthen Canada's competition legislation to guard against this possibility.

For the intercity bus market to operate competitively over the long term, potential competitors must have confidence that remedies to "abuse of dominant position" will be quick and firm to protect them effectively from anti-competitive acts, and to ensure that smaller carriers have a fair opportunity to compete. The present *Competition Act* is a substantial advance over its predecessor. The question is whether the Act and the adjudicative processes provide timely and decisive response and redress to encourage active and effective competition in a newly deregulated bus market.

Protection for the small local carrier that might choose to extend its operations into the routes dominated by a carrier many times its size, and with which it interchanges passengers and shares terminals, should fall within the "abuse of dominant position" and the "refusal to deal" provisions of the Act. Effective protection for the small potential competitor would also seem to require provision for compensation for damages resulting from anti-competitive acts engaged in by dominant firms, at least from the time of filing of a complaint. Although provision for damages would be similar to that under the criminal side of the Competition Act, enforcement under its civil provisions would seem a more effective approach for transportation.

Competition policy is of much more general application than transportation, and must take into account a range of considerations — including jurisdictional ones — which may be complex. If, however, the intercity bus industry is to be opened and regulatory controls lifted, and competition is to prevail over monopoly, there are concerns to address. Otherwise, potential entrants into the scheduled intercity bus services market could be discouraged by fears of anti-competitive behaviour.

## 11. CARRIER SUBSIDIES

A point frequently raised in discussions of deregulation is that some areas of the country will lose public passenger service, and to the extent that service will be seen as essential, subsidization will be required. Subsidization of rural bus services was provided for with deregulation in Britain; it is encouraging that subsidy costs reportedly have been significantly less than had been budgeted. When the U.S. deregulated interstate services, subsidy of services to smaller communities was also presumed but considered a state responsibility by Congress. More recently, a decision was made to contribute federal moneys to small community intercity bus subsidies.

In Canada, with regulation of the intercity bus industry still generally in place, there are instances of subsidy. Saskatchewan has two such programs. They support small carriers who supplement the services of the provincial Crown corporation, which is the principal supplier of bus transportation within Saskatchewan. Subsidy can also be achieved through public (government) ownership and operation at a loss.

Michigan, before deregulation, had a set of subsidy programs in place. These are more imaginative and varied than the traditional loss compensation programs and apparently have met the needs resulting from deregulation.

## 11.1 SASKATCHEWAN

There are three provincial government programs in Saskatchewan to ensure service to communities without sufficient traffic potential to make scheduled bus operations commercially viable. These are in addition to the government's ownership of the principal intra-provincial bus carrier, Saskatchewan Transportation Company (STC).

The Rural Bus Subsidy Program provides that if a bus operator applies to discontinue a service, and shows that it cannot be operated without a financial loss, the Department of Highways may provide a subsidy for its continued operation. This is done by public tender, with the service awarded to the carrier requiring the lowest amount of subsidy to provide the specified service. For example, until recently, Moose Mountain Lines Ltd. operated the service between Regina and Maryfield, as well as the one to Rocanville. It applied to discontinue both because they were losing money. The services were put to separate tenders. Moose Mountain was successful on only one, and the Maryfield service was awarded to Frances Enterprises Ltd., which had submitted a lower bid.

Under the Rural Transportation Assistance Program (RTAP) a community that can demonstrate a need for a bus service which is not, or no longer, being provided, can form a legal entity called a local transit authority (LTA) to provide the service. This LTA calls for tenders to operate a service linking the community to an STC point and awards a two-year contract to the successful bidder. Service is almost always provided with minivans. Fares are set by the provincial Department of Highways and Transportation (DHT). Revenues are collected by the LTA, which in turn pays the operator for the service. Shortfalls in revenue are met by the provincial government.

Finally, the relatively small Northern Feeder Program, which is similar to the RTAP, is specifically directed to ensuring service between remote communities in the northeastern part of Saskatchewan and STC points.

Under these programs, 467,000 bus-miles (756,000 kilometres) were operated in 1990 and 25,000 passengers carried. The amount paid out was $420,000. The numbers for the three programs are shown in Table 6.

*Table 6*
*SASKATCHEWAN INTERCITY BUS SUBSIDY PROGRAMS*

| | **Rural bus subsidy** | **Rural transportation assistance** | **Northern feeder** | **Total** |
|---|---|---|---|---|
| Bus-miles | 210,000 | 191,000 | 66,000 | 467,000 |
| Passengers | 12,000 | 8,000 | 5,000 | 25,000 |
| Subsidy | $150,000 | $265,000 | $8,000 | $423,000 |
| – per bus-mile | $0.71 | $1.39 | $0.12 | $0.91 |
| – per passenger | $12.50 | $33.12 | $1.60 | $16.92 |

The minivan services linking communities with the STC network under the RTAP require greater subsidization per bus-mile and per passenger than the standard bus services under the Rural Bus Subsidy Program. It is logical to assume that the latter are better used than the former.

For perspective, it might be useful to compare these amounts with the subsidy paid in 1990 for operation of remote rail service between The Pas and Lynn Lake in Manitoba. VIA Rail handled about 8,600 passengers and was paid $1,596,000 ($186 per passenger), compared to the Saskatchewan bus subsidies of $423,000 for 25,000 passengers ($17 per passenger). The above should not, in any way, be interpreted as critical of the management of VIA which provides a different type of service subject to different costs; it is merely presented as an indication of scale against which the cost of the bus subsidies might be assessed.

## 11.2 MICHIGAN[35]

In the United States, the federal government has jurisdiction over interstate transportation, including buses. Operations within a state fall under state jurisdiction. The *Bus Regulatory Reform Act of 1982* (BRRA) deregulated the interstate bus industry. The states reacted in different ways. Some left the regulatory regime in place, others instituted various small degrees of deregulation. Two states, Florida and Michigan, removed all entry, exit and rate regulation immediately following enactment of the BRRA.

Michigan does not simply provide state funds to make up the operating losses of bus services to ensure continuation of essential service. It does this when necessary, but only after evaluation of the service and a competitive bidding process to encourage efficiency and minimize cost. To reduce the necessity of these operating subsidies, the Michigan Department of Transportation (MDT) tries to retain service with other more imaginative schemes, which provide help to carriers and communities to improve the probability that service can be operated profitably. In one community this might be improvements to the bus terminal; in another, a new one. One area might be served by a carrier with buses owned by the state, in another there might be a major bus marketing campaign organized by a professional agency and funded by the state.

Before deregulation, the MDT had a program in place to provide assistance to the intra-state scheduled bus industry. The Intercity Bus Program was planned as a result of the energy shortages of the early 1970s and was introduced in 1976. It comprises individual programs which provide assistance in a variety of forms.

The Bus Passenger Terminal Program assists carriers or communities with the development, construction or rehabilitation of bus terminals. It also pays for security in terminals to improve safety, enhance perception of their safety and extend open hours.

The Intercity Bus Capital Equipment Loan Program provides for the state to own buses and make them available to bus operators through a contract lease arrangement. This is intended to be in lieu of assistance under the Intercity Bus Operations Program, but can be an incentive to establish new bus companies.

The Intercity Bus Operations Program uses the competitive bid process to fund "operating projects for purchase of intercity regular-route services" to prevent isolation of communities, to provide essential transportation, to respond to the effects of deregulation, and to introduce new services. Under this program, an unprofitable service is operated under a two-year contract with the carrier which submitted the lowest bid. There are three other programs which support the Bus Operations Program.

The Regular Route Saviour Program is intended "to create a climate in which bus companies can be profitable on a regular scheduled route and, thus, would not consider service elimination on that route." State funds can be provided for public relations campaigns to educate the public about the importance of the bus services to the community.

The Service Continuation Program provides funds to a carrier applying for discontinuance of service, which would cause isolation of an area. The funds enable the carrier to continue to provide service until an evaluation has been carried out and a contract has been awarded under the Bus Operations Program. A service which already has been discontinued can be resumed temporarily under this program.

The Demonstration Project Program provides funds for experimental projects. These may include service to a new market area, innovations in public service or testing of new technology.

## 12. GOVERNMENT OWNERSHIP OF CARRIERS

Direct subsidy can be avoided through the ownership of bus transportation enterprises by federal, provincial or municipal governments. Most publicly owned carriers are established to provide service which is considered economically or socially necessary or desirable, but which is not provided, or adequately provided, by the private sector. A government service can be the sole or major provider of the bus transportation (as is the case in Saskatchewan), a supplement to the private industry (as in Prince Edward Island), or a regional service provided to encourage development (as in northern Ontario).

Research suggests that Crown carriers are a relatively inefficient means of delivering transportation that might be deemed socially necessary. The international example, typified by Britain, has been toward privatization with revenue supplement through public tender if necessary.

## MUNICIPAL GOVERNMENT OWNERSHIP

A municipal or regional government's public transit system may expand into the intercity scheduled and charter market for a variety of reasons. One might be no more than an attempt to find a profitable sideline to help subsidize the transit system. Expansion of the scope of its bus operations might bring a city economic benefits from more effective links with other communities and outlying areas.

Gray Coach Lines was originally the creation and subsidiary of the Toronto Transit Corporation (TTC) but was sold and is now in private hands. The TTC retained the bus terminal in Toronto, which it recently rebuilt.

The Hamilton Street Railway, the urban transit system owned by the Regional Municipality of Hamilton-Wentworth, owns and operates Canada Coach Lines, a charter and scheduled bus operation. Its intercity scheduled service joins Hamilton with Buffalo and points throughout the Niagara Peninsula, as well as Brantford, Cambridge, Kitchener, Waterloo and Guelph.

Its 1989 accounting records suggest that Canada Coach Lines is not subsidizing the public transit system or vice versa. It does provide, however, a service to the population of Hamilton-Wentworth, which probably also gains from the transportation links to the areas it serves.

## PROVINCIAL GOVERNMENT OWNERSHIP

The Ontario Northland Transportation Commission (ONTC) is a money-losing but expanding organization. It was founded by the Ontario government about 90 years ago to provide transportation and communications services essential to the development of the northern part of the province. It now operates a network of rail, air, marine, telecommunications, trucking and bus services in northern Ontario.

ONTC had consolidated operating profit in 1989 of $14.1 million, on revenues of $142.6 million. These revenues include $24.8 million of subsidy payments.[36] Excluding these payments, ONTC had revenues of $117.8 million in 1989, and an operating loss of $10.7 million.

ONTC's bus division operates charter and tour services as well as a network of intercity scheduled routes. Recently, it has expanded out of the remote access role for which it was created. The bus division earned revenue in 1989 of $5.1 million (which includes no subsidy payments) and experienced an operating loss of $79,000. In the previous year its operating loss was $319,000, on revenues of $4.3 million.

Too recent to be reflected in the above results, Ontario Northland's bus division has purchased the rights from Gray Coach Lines to operate scheduled services on a number of routes north from Toronto. As mentioned above, the new routes will enable ONTC to operate from its present territory through to Toronto, and to expand into the Bruce Peninsula. Also included are contingent charter and tour rights. The new routes which will connect Toronto with its present northern network have been advanced as a logical and practical expansion of ONTC's northern development role, notwithstanding the fact that the Sudbury–Toronto route is served by Greyhound.

The new routes to Midland, Penetang, Collingwood and Owen Sound, however, are more difficult to rationalize with the original objectives of Ontario Northland. The area is not lacking in development nor infrastructure. The routes are served by Penetang-Midland Coach Lines, with at least two daily departures each way in the Collingwood and Owen Sound service, and at least three in the Midland and Penetang service. It would appear, therefore, that this acquisition is an expansion of ONTC's bus network to meet its own commercial objectives and an expansion of its mandate beyond that of an instrument of development for northern Ontario.

There are two other examples of provincial Crown corporations operating in Canada, a rather large one in Saskatchewan and a very small one in Prince Edward Island.

Saskatchewan has the most extensive bus network of any province in the country. Most of the intra-provincial routes belong to Saskatchewan Transportation Company (STC). As described earlier, its service is supplemented by private carriers operating over connecting routes, particularly in the northeast, on behalf of STC, or under one of the province's subsidy programs. Fares in Saskatchewan are among the lowest in the country; this low level applies to the Saskatchewan segments of Greyhound's trans-Canada routes as well as to the intra-provincial network.

For the year ending October 31, 1990, STC incurred a loss (after depreciation and interest) of $5.339 million, on revenues of $16.216 million. This loss is 17 percent greater than it was in the preceding year, and 90 percent greater than in 1985-86. When combined with the $423,000 cost of subsidy programs described earlier, this loss represents a total subsidization of the intraprovincial bus industry by the Saskatchewan government of $5,762,000.

STC operated 5.63 million bus-miles and carried 648,000 passengers in 1989-90. The operating loss is equivalent to 95¢ per bus-mile, or $8.24 per passenger. This is more per bus-mile than the cost of the Rural Bus Subsidy Program, but less per passenger.[37] The difference per bus-mile suggests that the small contract carriers under the Rural Bus Subsidy Program, operating services not sufficiently profitable for STC, are doing so at a higher level of cost efficiency than STC, with presumably lower load factors and shorter trips.

The Government of Prince Edward Island owns Island Transit, which is small and operates a summer-only scheduled service. Until this summer it also operated a service from Charlottetown to New Glasgow, Nova Scotia, via the Wood Islands ferry. Island Transit does not operate charter or tour services. As already discussed, SMT (Eastern) of New Brunswick is the major carrier in Prince Edward Island.

## FEDERAL GOVERNMENT OWNERSHIP

Before joining Canadian Confederation in 1949, Newfoundland had a government-owned national railway, which provided most of the passenger and freight transportation in the country; coastal vessels were the other important mode.

The Terms of Union[38] called for the Government of Canada to "take over . . . and . . . relieve the Province of Newfoundland of the public costs incurred in respect of . . . the Newfoundland Railway" (paragraph 31), and the railway became the property of Canada (paragraph 33). The Canadian government incorporated the Newfoundland rail service in the mandate of its Crown corporation Canadian National Railways.

As was happening throughout North America, the car and the truck began to grow in importance in intercity passenger and freight transportation. This was aided by completion of the Trans-Canada Highway in Newfoundland.

Soon the viability of the railway service in Newfoundland was questioned. By 1968, after a lengthy campaign, CN received permission to abandon its passenger rail service on condition that it substitute an equivalent bus service. The result is that the major passenger carrier in Newfoundland, CN Roadcruiser, is a bus service owned and operated by the federal government. It is also the only bus service under federal regulatory jurisdiction (for reasons described earlier).

Roadcruiser loses money. It does so operating over the province's densest corridors, while smaller locally managed operations seem viable. The Roadcruiser operation, until recently, was included in CN's railway organization as an operating division with the typical railway organization and management structure designed for, and experienced in, operating a freight railway. A few years ago, this was changed and Roadcruiser was given its own organization, more suitable to a bus operation, but still reporting to senior railway freight experts.

Roadcruiser's driver costs appear to be appreciably higher than the industry average. CN's vice president in Moncton explained that this results from drivers being railway employees, who have benefited from wage levels and increases over the years enjoyed by employees of the railway industry across Canada. CN is hoping to separate Roadcruiser employees from the labour contracts and wage levels of their rail operations, but does not expect this to be an easy or short-term project.

Roadcruiser could be described as an evolutionary anomaly. It is the only bus service operated by CN, and the only passenger service. In 1949 it was part of a rail operation and, at that time, CN operated rail passenger services throughout Canada. Neither is true now, but history has left a reluctant CN with a passenger bus service. Logically CN should be relieved of this operation, but this probably will happen only after agreement has been reached to provide financial compensation from the federal government.

There are a number of ways Roadcruiser could be removed from CN. Its assets and rights could be sold to a private carrier. It could be taken over and operated by the province. Subsidized operation over its routes could be arranged by public tender (there are a number of small rural bus lines in Newfoundland). Under any of these alternatives, the operation would revert to provincial jurisdiction[39] under existing legislation. Unless costs could be reduced without any revenue depletion, fares would rise or subsidies would persist. The operation has, in the past, been perceived as a constitutional obligation of the federal government. When the Newfoundland railway was shut down in 1988, however, Premier Peckford stated publicly that no constitutional obligation to maintain the railway existed.

## 13. SCENARIO FOR THE FUTURE

The *Motor Vehicle Transport Act, 1987,*[40] implemented a substantial measure of deregulation for trucking, but did not extend it to busing. It would be difficult for the Commission to ignore the question of whether the "reverse onus" principle should be extended to bus regulation, or whether some other form of deregulation or regulatory revision should be recommended.

Although the broad deregulation of extra-provincial bus undertakings is not the only option for change, it is the most extreme. The deregulation scenario assumes substantial — even dramatic — change for Canada's intercity bus industry. The federal *Motor Vehicle Transport Act* is presumed amended to relax the regulation of extra-provincial busing. Faced with the potential flight of aspiring new competitors and territory defenders alike to federal jurisdiction, the provinces follow suit.

The revised legislation reduces entry restrictions to a performance bond and adequate insurance. The bond is against prepaid tickets and for route abandonment without the required (four weeks) public notice. Provisions require tariff filings, and schedules and fares publication.

Fare increases are subject to publication with two weeks' notice. There are no onerous filing and publication requirements. Prominent display at a company's terminals and on its buses is all that is required. A copy of the posted notices mailed to the National Transportation Agency constitutes filing.

A provision in the legislation specifies that, in spite of the residual degree of regulation, the bus mode is subject to competition legislation. Further, sanction of collective rate making is restricted to joint interline and/or intermodal fares. The *Competition Act* is presumed amended to include provision for private parties to bring "abuse of dominant position" and other reviewable trade practices before the Competition Tribunal. There is also provision for awarding damages for conduct contrary to a civil provision of the Act.

It is safe to assume there would be changes if the industry were deregulated. What these changes might be would depend, however, on many factors other than the regulatory regime. These include economic conditions, government policies in related areas, such as highway policies or fuel prices, or in not directly related areas, such as taxation policy.

There would be changes in or removal of situations which exist only because of regulation. Cross subsidization, that is, unprofitable but obligatory services financed by profitable services, was discussed earlier. This is a standard characteristic of a regulatory system which provides exclusive rights to a carrier in a region; the profits from "monopolistic pricing" are in effect "taxed back" in the form of unprofitable but socially desirable services.

With deregulation, these carriers would be deprived of their exclusive rights. Their profitable routes would be subject to competition, and the fares they charge would presumably be reduced. This removes the financial ability and incentive to provide unprofitable services. Regardless of what happens to its prices, the carrier would no longer have reason to finance services that, on the margin, were unprofitable.

The bus industry has told us that, without the present system of regulated monopolies, many small communities would lose their service. This is the predominant defence of the status quo. It is asserted that regular service to small communities at restrained prices is only possible because carriers are required or expected to provide it as a condition of authorities to operate profitable scheduled routes and charter services. One carrier officer stated that the day after regulatory reform his company would withdraw service from more than a hundred communities. But, there are reasons why carriers might be cautious and analyze the market carefully before abandoning feeder routes that might give a potential competitor a strategic advantage.

In a newly deregulated environment, identification of the correct commercial decisions would be difficult. Some carriers who terminate services might find that the loss of elements of their networks undermines their competitive position in the passenger and parcel markets as a whole.

It is safe to assume that a significant proportion of routes would be discontinued, and some communities deprived of service. Where the affected population or government consider some public transportation to be socially necessary, or necessary to improve or ensure the economic viability of a community or area, a way would be found to provide it. Some of these routes would survive in much the same form, but with reduced frequency and increased prices. In other areas, the vehicles used to provide the service would be more suitable to volume demands. Thus, more smaller, older buses and part-time operators with minivans would appear in lower-population regions. As already described, this is a common practice in Newfoundland.

Some of the routes apparently sustained by cross subsidization are unprofitable only if analyzed in isolation. These make a contribution to the profits of other routes by feeding traffic to them, or providing connections crucial to the attractiveness of the bus service. It, however, is unlikely that the bus system would develop or sustain a hub-and-spoke network directly comparable to what has occurred for air because each spoke would be a local service capable of stopping en route, unlike the airlines' networks where all passengers are brought to the hub for potential onward connection regardless of their intended destination.

It is probable that the core high-density routes in any region would be operated by a single, large dominant carrier, possibly two, with the economies of scale derived from the flexibility of a large fleet, terminals in major cities, automated systems for tariffs, ticketing, reservations and scheduling, and a large-scale marketing and advertising program. Feeder services would not make profitable components of this carrier's empire, and one would expect to see them operated by a plethora of small regional or local bus lines, some of whose cash box (passenger and package) revenues would be supplemented by commissions from the core carrier.

Whether these would be franchised carriers, using the core carrier's name and logo ("Greyhound Puppies" and "Voyageur Cubs"?) or interlined in some less complete way and perhaps not paid for transferred passengers could mean the difference between success or failure of the low-density routes. The carriers which connect with the mainline (probably continental) carrier in the latter's bus terminals in major centres, would also have small offices in hotels or other locations in some communities. The others, the non-interlined, would merely pick up and drop off passengers at hotels, street corners or designated highway locations with the more successful among them finding other local connections to serve.

In an environment of reduced regulation, the large dominant carriers are not expected to be completely immune from competition. There would be instances of some degree of challenge on the high-density routes, probably both by high performance and comfort, and by low-cost bargain services. So long as the adopted, reformed regulatory regimes contained effective and speedy remedies to predation, the ability of even a single continental carrier to exact excessive monopoly rates should be controlled.

A continental bus carrier may not serve the entire country. It is possible that in some areas, such as eastern Quebec and the Atlantic provinces, the combination of a strong local competitor and limited volumes would deter attempts at entry from major outside carriers. The result would be a proportionately smaller but equivalent regional network, again a single dominant carrier, with a network of local feeder lines.

Specialized bus systems would find niches. Some would be a form of commuter service, linking large cities with areas outside the range of urban transit, perhaps even intermingling with the transit system. Others would serve the needs of a region, such as the Bruce Peninsula or Vancouver Island, providing intra-regional bus services, rather than connections between big cities. Another example of similar systems would be summer-only services in tourist or summer cottage regions. There are examples of these services now.

Bus service pricing would change considerably. The one, possibly two, major core bus network(s) would require rather high load factors to support large-scale operations and investment. This would necessitate a more scientific and creative pricing system than is in place now in most bus companies. This is not to suggest any deficiency in the industry itself. Voyageur Colonial, for one, has several discounts, same day return fares and other incentives in place. The main factor preventing more pricing initiatives is the generally high level of fare regulation.

The objective, to keep buses full, can be pursued on two fronts. One is the reduction of imbalances in traffic, and the negative effects they have on fleet size and average use of almost all assets. The other is the increase of traffic volume, involving growth in the travel market share (intermodal competition) and growth in the total travel market. There would be fare incentives to promote travel in off-peak seasons of the year, off-peak days of the week, and off-peak times of the day. There would also be innovative pricing and other incentives along the lines of excursion fares and tour packages including hotels to encourage people to travel or to travel without their cars.

# APPENDIX A

## HISTORY OF REGULATORY RESPONSIBILITY FOR INTERCITY BUS TRANSPORTATION

### Early History

Under the provisions of the *British North America Act, 1867,*[41] section 92, the provinces have the authority to regulate highways and the manner in which they are provided. By extension, the provinces have authority over the users of these highways, and this includes public buses. Section 92(10)(a), however, describes certain exceptions to provincial jurisdiction, including "Works and Undertakings connecting the Province with any other or others of the Provinces or extending beyond the Limits of the Province."

In 1949, Israel Winner of Lewiston, Maine, applied for and was granted a licence by the Motor Carrier Board of New Brunswick, to operate public motor buses from Boston, Massachusetts, through New Brunswick to Glace Bay and Halifax, Nova Scotia, and vice versa. The licence contained the restriction "not to embus or debus passengers in the said Province of New Brunswick." Winner considered the New Brunswick legislation under which the licence was issued to be *ultra vires*. Consequently, he ignored the restriction and carried passengers to, from and between points in New Brunswick, along the route over which he was authorized to operate.

SMT (Eastern) went to court seeking an injunction to restrain Winner from embusing and debusing passengers within the province; a declaration that he had no legal right to do so; an accounting of fares received for this; and damages and costs. The legal questions were referred to the Supreme Court of New Brunswick, which ruled the licensee was prohibited from his actions, and the legislation under which he was prohibited was "*intra vires* of the Legislature of the Province of New Brunswick."

Winner appealed to the Supreme Court of Canada, which, in a 1951 majority decision, ruled that "a bus line consisting of the service of carriage along with the means and organisation, may be an 'undertaking' within s. 92(10)(a) of the *B.N.A. Act*. . . . [and that] federal authority attaches to an undertaking although it originates in a foreign country (e.g., in the United States) and connects with one or more Provinces. Nor need the connection be physical."

In regard to the intra-provincial operations of an extra-provincial carrier, the Court ruled:

> the Province has power to control purely intraprovincial bus traffic. In this respect there is a difference in the position of an interprovincial or international bus line and the position of an interprovincial or international railway or telegraph system. These latter are specifically mentioned in s. 92(10)(a) and all their operations in their constitutional ambit fall within exclusive federal control regardless of the geographical points within which they occur.

The Supreme Court decision was reviewed by the Judicial Committee of the Privy Council which, in 1954, reversed the latter ruling, finding instead that as with a railway or telegraph system, the federal government has jurisdiction over all of the operations of a highway transport carrier that engages in any interprovincial or international operations.

The federal government came unexpectedly and immediately under strong pressure. The administrative infrastructure was not in place to take over motor vehicle regulation immediately. Meanwhile, the industry was trying to promote this new opportunity to escape from multiple regulatory jurisdictions. At the same time, however, the provinces made strong representations for mandated control over extra-provincial motor vehicle carriage. Control over motor vehicle operations, particularly trucking, provided an important source of political and commercial influence for provincial governments.

The federal *Motor Vehicle Transport Act* (MVTA) was enacted in 1954. It delegated federal authority over all the operations of extra-provincial motor carriers to the provinces. The provincial regulatory boards retained this authority, subject to the power of the federal government to "exempt" a specific motor vehicle undertaking from its terms, thus returning it to federal jurisdiction.

### Existing Legislation

The *Motor Vehicle Transport Act, 1987* was substantially changed from the 1954 Act with respect to trucking, but for bus it is essentially unchanged. In Part I, Bus Transport, it reads:

### *Operating Licence*

4. Where in any province a licence is, by the law of the province, required for the operation of a local bus undertaking, no person shall operate an extra-provincial bus undertaking in that province except under and in accordance with a licence issued under the authority of this Part.

5. The provincial transport board in each province may, in its discretion, issue a licence to a person to operate an extra-provincial bus undertaking in the province on the like terms and conditions and in the like manner as if the extra-provincial bus undertaking were a local bus undertaking.

### *Tariffs and Tolls*

6. Where in any province tariffs and tolls for local bus transport are determined or regulated by the provincial transport board, the provincial transport board may, in its discretion, determine or regulate the tariffs and tolls for extra-provincial bus transport on the like terms and conditions and in the like manner as if the extra-provincial bus transport were local bus transport.

Also, Part IV, Exceptions and Enforcement of the Act states:

### *Exemption*

16. The Governor in Council may, by regulation, on the recommendation of the Minister made after consultation by the Minister with the government of each province affected thereby, exempt from the application of this Act or of any provision of this Act, either generally or for a limited period or in respect of a limited area, any person, the whole or any part of any extra-provincial bus undertaking or extra-provincial truck undertaking, every extra-provincial bus undertaking or extra-provincial truck undertaking, any group or class of such undertakings or any extra-provincial bus transport or extra-provincial truck transport.

### Experience with the Exemption Provision

The only exemption to provincial regulation under the provisions of the MVTA has been in Newfoundland. (While this exemption occurred under the 1954 Act, the relevant provisions of the 1954 and 1987 Acts are very similar.) A Canadian National Railways subsidiary, CN Roadcruiser, was introduced in 1968 when authority was granted to abandon the passenger rail service (the Newfie Bullet). CN Roadcruiser was authorized to operate in accordance with the provincial *Motor Carrier Act*. A series of appeals by Roadcruiser against the 1971 disallowance of a tariff by the Board of Commissioners of Public Utilities of Newfoundland (PUB), culminated in a 1975 Supreme Court decision that the service should be regulated under the federal legislation.

This changed the legislative authority under which Roadcruiser operated, but it did not remove it from the jurisdiction of the PUB. The PUB issued the appropriate certificate of authority, but placed restrictions on its tariff, which Roadcruiser appealed. Poor relations between Roadcruiser and the PUB eventually resulted in service being halted. The Government of Canada issued an Order in Council exempting the Roadcruiser service from the MVTA pursuant to section 5[42] of the Act. Under the *National Transportation Act* (1967) the Roadcruiser service then became subject to regulation by the Canadian Transport Commission.[43]

As viewed from our present perspective, the Governor in Council exempted a purely intra-provincial bus operation where the extra-provincial parent (Canadian National Railways) had no bus operations anywhere else in the country. This of course results from the Supreme Court decision that the service was "a part of the total Canadian Passenger Service operated by Canadian National and therefore should properly be regulated under the federal [Act]." Of course, now this is Canadian National's only passenger service as well as its only bus service, and it is interesting to speculate what decision the Court might reach today.

## ENDNOTES

1. Statistics Canada, *Canadian Civil Aviation*, Catalogue No. 51-206, Table 2.2, and *Passenger Bus and Urban Transit Statistics*, Catalogue No. 53-215. Passenger-kilometres based on bus load factor of 38 percent, from D. Ward, *Profile of the Intercity Bus Industry* (Ottawa: Transport Canada, October 1990).

   Railway statistics were taken from unpublished data from the Transportation Division, Statistics Canada.

2. Local service in Newfoundland is by a number of small operators, often with small vehicles.

3. In the case of Greyhound, reference is to the charter use of its "Greyhound" line-haul buses. The company also owns Brewster Transport Company Ltd., which operates exclusively in the charter market. (Some Brewster buses are chartered occasionally by Greyhound during peak demand.)

4. Excluding Brewster.

5. Most of this section was prepared by Royal Commission staff member Pierre Dulude.

6. Experience with wheelchair-accessible coaches has been disappointing. Ridership by those requiring the facilities has been very low. The incremental cost per passenger with a mobility impairment has been very high. Industry asks us who will pay the cost and questions whether bus passengers, who tend to come from the lower-income groups, should pay for this other disadvantaged group.

7. *Official Canadian Bus Guide* (Cedar Rapids, Iowa: Russell's Guides, Inc. January–March 1991).

8. The provisions of this Act and its history are discussed in Appendix A.

9. Two studies of the bus industry were undertaken for the Commission by consultants: Peat Marwick Stevenson & Kellogg, *Intercity Passenger Bus Regulation in Canada*, a report prepared for the Royal Commission on National Passenger Transportation, RR-02, July 1991; Hickling Corporation, *Regulatory Reform in the Intercity Bus Industry: An International Comparison*, a report prepared for the Royal Commission on National Passenger Transportation, RR-06, September 1991.

10. Voyageur Colonial's former sister company in Quebec.

11. See endnote 7.

12. Owned by Pacific Western Transportation Ltd., Calgary.

13. Lorraine C. Hope and Barry E. Prentice, Transport Institute, University of Manitoba, *Analysis of Scheduled Bus Service in the Canadian Prairies (Draft)*, prepared for Economic Research Branch, Transport Canada, TP 11135-E, October 1991.

14. Like Red Arrow, Western Trailways is owned by Pacific Western Transportation Ltd., Calgary.

15. See endnote 7.

16. There is little (if any) price competition in the scheduled intercity bus industry. This is discussed later in section 6.2 which deals with intra-modal competition.

17. See endnote 7.

18. Bus fares used here are from the *Canadian Passenger Tariff No. 1* (Chicago, Illinois: National Bus Traffic Association, Inc.). They are the fares in effect July 15, 1990, just before the Commission's public hearings. They are used here to compare fare levels within the bus mode, rather than to make comparisons between modes, or to try and estimate current travel costs.

19. Generally, carriers operate in miles internally (there are exceptions) and convert to kilometres when required.

20. Newfoundland is not included in this discussion of interprovincial fares. Fares are not published nor tickets sold between points in Newfoundland and other provinces; not even tickets for the ferry service to Nova Scotia are available from Roadcruiser.

21. Voyageur Colonial significantly increased and restructured its fares during 1991 (in response to increased use of discount fares by VIA Rail).

22. The word "competitive" is used loosely in this context. It refers to segments over which buses of more than one carrier operate. These may be no more than relatively short overlaps of two routes, or they may be routes where two or more carriers compete. For instance, Greyhound and Gray Coach Lines do compete on the Sudbury–Toronto segment.

23. 365 miles for the local service at the same fare.

24. See endnote 1.

25. This service is licensed as Airways Transit Service Ltd. Also noteworthy in this context, a service operated by Quick Coach Lines Ltd., and licensed to operate from Vancouver to Bellingham and Sea Tac airports, and to (actually through) downtown Seattle, provides service to intermodal travellers and to origin-destination travellers (in competition with Greyhound).

26. The cost and revenue schedules, from which these conclusions have been reached, were developed from corporate data provided to the Royal Commission's Research Division in confidence.

27. Explorations of this question with analytical staff of another major carrier revealed that it will be very difficult for carriers, faced with a newly deregulated environment, to identify the correct commercial decision in every case. Doubtless, were deregulation to occur, some carriers who terminate services might find that the loss of some of these elements of their networks undermines their competitive position in the passenger and parcel markets as a whole.

28. *Canadian Passenger Tariff No. 1.*

29. The methodology does not account for other fare levels (discounts for senior citizens or students, same day return reduced fares, etc.), and to that extent the calculated break-even passenger load is understated.

30. For a local service, the sum of the individual bus fares for the route segments was used.

31. This would seem a reasonable assumption, particularly if one considers the low absolute level of present fares for the usually short trips concerned, and/or if one accepts the argument that the withdrawal of service would cause severe social hardship.

32. Most of the material in this section was taken from two reports on the bus industry prepared for the Royal Commission: Peat Marwick Stevenson & Kellogg, *Intercity Passenger Bus Regulation*, RR-02, July 1991, and Hickling Corporation, *Regulatory Reform in the Intercity Bus Industry: An International Comparison*, RR-06, September 1991.

33. Jose A. Gomez-Ibanez and John R. Meyer, "Privatizing and Deregulating Local Public Services, Lessons from Britain's Buses," *APA Journal* 9, winter 1990.

34. Hickling, Regulatory Reform, citing European Council of Ministers, *Regulating Reforms in the Transport Sector*, Madrid, 26–27 May 1987.

35. The information in this section is taken from the report by Peat Marwick Stevenson & Kellogg, *Intercity Passenger Bus*.

36. These payments include compensation of $22.4 million from the Ministry of Northern Development and Mines, in accordance with a fixed-price contract, for operations designated "non-commercial": rail $17.8 million, air $4.5 million; and marine $62,000. The remaining $2.4 million was compensation from the Government of Canada for losses on the passenger rail service between North Bay and Toronto, in accordance with section 261 of the *Railway Act*.

37. The higher amount per bus-mile and lower amount per passenger probably reflect higher average load factors.

38. *Newfoundland Act*, R.S.C. 1985, Appendix II, no. 32.

39. The Supreme Court's reason for its 1975 decision was that the bus service was a part of the total integrated bus-ferry passenger service operated by CN, and particularly its integration with the ferry mode. Presumably, with other than CN operation this no longer would be true. In this regard, it is noted that CN no longer operates the ferry service.

40. See Appendix A.

41. Now called the *Constitution Act, 1867*.

42. MVTA section 6 (previously section 5) stated:

> 6. The Governor in Council may exempt any person or the whole or any part of an extra-provincial undertaking or any extra-provincial transport from all or any of the provisions of this Act. R.S., c.M-14, s.5.

This wording seems, to the layman, merely a more concise (if less conciliatory) expression of the MVTA, 1987 section 16 quoted earlier. So, similar power persists.

43. As with the MVTA, the NTA of 1967 and the NTA, 1987 are similar in this regard. Part IV of NTA, 1987 provides for the regulation of bus transport by the National Transportation Agency but specifies:

> 184. (1) While the *Motor Vehicle Transport Act, 1987* is in force and notwithstanding anything in this Act, this Division applies only in respect of such extra-provincial bus undertaking or such part thereof as is exempted from the application of the *Motor Vehicle Transport Act, 1987* pursuant to section 16 of that Act.

## 17

# VIA RAIL SERVICES: ECONOMIC ANALYSIS

Charles Schwier* and Richard Lake**

July 1992

## 1. INTRODUCTION

This paper examines the present cost structure of VIA Rail Canada and presents a costing model which allows for the determination of fully allocated costs by groups of VIA Rail passenger services and the integration of anticipated changes in the efficiencies, equipment and mode of operation for future railway passenger services. This model is then used to examine the total costs, financial results and projected deficits for a variety of Canadian rail passenger services. Recent Canadian results are compared to the results of the United States railway passenger system, Amtrak. The context for the economic analysis of VIA Rail is also presented.

Section 2 provides a historical summary of VIA's overall financial and operational indicators plus a service-by-service summary of 1989 results. Although later data are available, circumstances (particularly in 1990) were most unusual; reference is only made to these results as they might indicate trends unrelated to or beyond the major service cuts executed during that year.

Section 3 describes the costing model and procedures for projecting the future financial viability of VIA's services. The Montreal–Ottawa–Toronto service group is used as an example. Using this model, Section 4 summarizes the projected costs and revenues for a number of VIA's service groups assuming what for convenience is called a "steady-state environment" or "adjusted case" which allows for improvements from emerging demand growth, productivity improvements and equipment upgrades reasonably foreseeable in the next few years.

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In Section 5, the recent financial experience of VIA is contrasted briefly with results for a number of foreign passenger railway systems. The financial progress of Amtrak is examined in more detail and compared with VIA's financial experience. Reasons for differences are offered.

Sections 6 and 7 consider the institutional and policy-setting environment in which VIA has operated and the way in which this setting may have affected the internal operations of VIA. Of special interest is the influence these factors may have had on VIA not achieving the level of financial improvement that Amtrak has experienced over its first 15 years of life. Implications concerning VIA direction and management are discussed in Section 7.

In Section 8, each of the eight mandatory remote services which VIA operates are examined in some detail, especially the ridership patterns and options for the future.

The prospects for viability of VIA's rail passenger services and the concerns that large VIA subsidies pose with respect to equal treatment of modes are discussed in Section 9. This is followed in Section 10 by an estimation of the one-time costs that would be incurred if VIA — and federally supported rail passenger services — were terminated.

## 1.1 RAIL'S INHERENT CHARACTERISTICS

The transportation of passengers by rail has certain inherent characteristics that distinguish it from the service provided by the other modes. These are the characteristics that attract those who extol the virtues of rail, and they are the characteristics that should dictate VIA Rail's niche as Canada enters the next century with a mature transportation system.

### Capacity

Trains can move a large number of people. A double track could handle 25 trains per hour each way, each carrying in excess of a thousand persons.[1] This is three times the hourly capacity of a four-lane freeway with an average of two persons per car. It equals the hourly capacity of four runways handling aircraft each carrying 350 passengers. It would be, however, of less capacity than a two-lane highway dedicated to 47-passenger buses. Regardless, such capacities are an order of magnitude above anything VIA Rail might have reason to contemplate.

### Service Capability

Rail is able to provide very comfortable service with a wide range of amenities, and can do so at speeds of 300 kilometres per hour.[2] Magnetic levitation will probably allow speeds of 500 kilometres per hour. Railway technology is capable of operation under extreme weather conditions and with zero driver visibility.

### Environmental Impact

Railway noise has a substantial but local effect. Tracks can interrupt drainage and trains can be a hazard to wildlife if the right-of-way is not fenced, and an obstruction to animal migration where it is fenced. However, rail does not allow uncontrolled access by passengers to sensitive areas through which the track passes.

It is practical to operate trains using electric power. If this power were generated from hydraulic or other non-combustion sources, rail could be the least emissions-causing mode. Current railway diesel systems, however, emit both carbon dioxide and nitrogen oxides (that cause harm to both the natural environment and human health). For current railway services in Canada, emissions per passenger, while often lower than for cars, are substantially higher than for intercity bus. Transcontinental train (sleeper) travel with current equipment can consume more fuel per passenger than any other mode, and thus pollute more.

### Economics

Operating a railway passenger service is expensive. Track is expensive to build and expensive to maintain. A rail car is many times heavier than a bus and, with its share of the locomotive, costs 7 times as much while having a capacity of less than twice as many passengers. The operation and control of trains are complicated and labour intensive. Cost per train hour is high.

If trains are to be economical, relative to the other modes, they must be intensively used. One must move a lot of seats quickly, and they must be full. Rail can only be successful if it is fast and supported by many riders who value the comfort and amenities it offers and are prepared to pay for them.

## 1.2 CANADA'S RAILWAY PASSENGER SERVICES

For more than half a century the railways were the only practical means for passengers to cross Canada or to reach its interior. Alternatives to rail travel were best characterized as tests of endurance and survival; they were adventures suited only to the fittest. Most of interior Canada's population arrived by train.

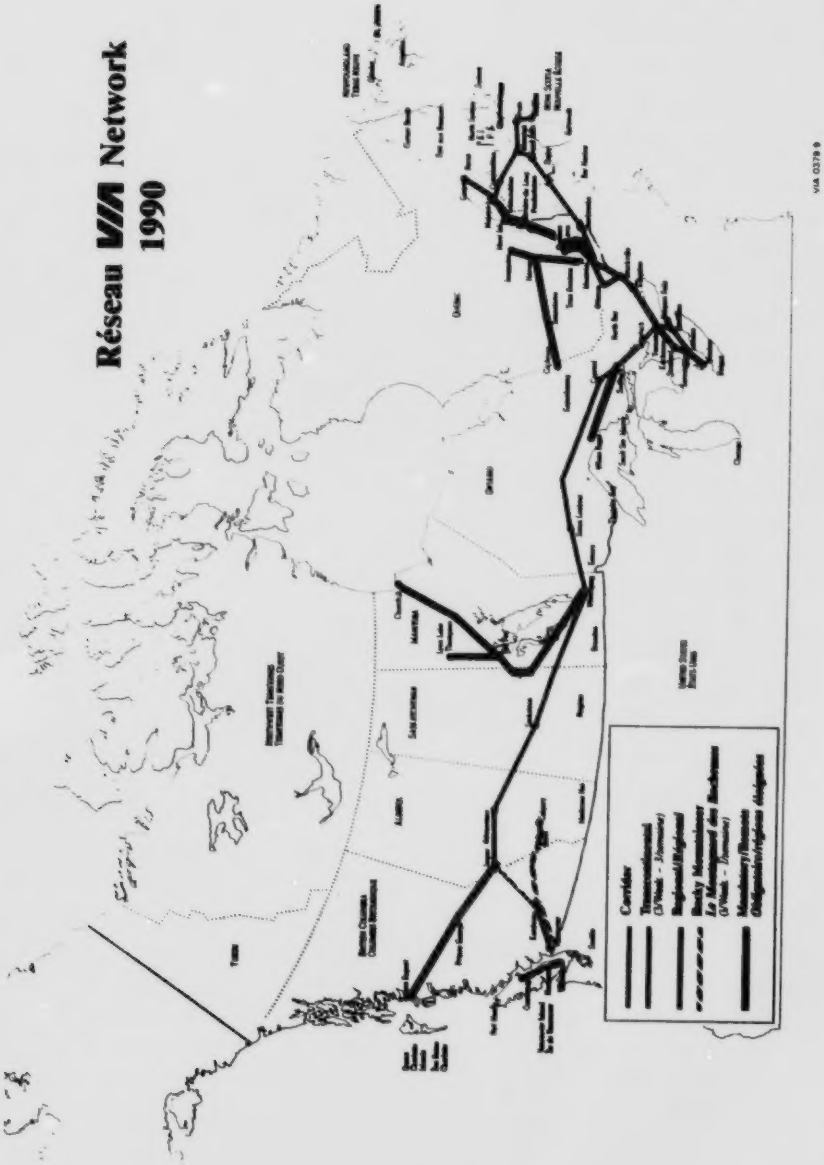
While the railway is important in Canada's history, the present is quite different. Even in the developing world, few countries depend on rail for their basic passenger access. In Canada, use of rail has faded. Rail remains an important long-distance mode in China, India and Russia, and it is important in the more compact countries of developed Asia and Europe, but not for long-distance travel. Passenger rail in Japan and Europe is essentially a short distance mode; most travel is less than 100 kilometres. As in Canada and the United States, passenger rail in Europe and Japan is, on average, subsidized.

In 1976, Dr. R.A. Bandeen, then President of Canadian National, apparently without the knowledge of the government, sponsored a major promotion of an Amtrak-style approach for railway passenger services in Canada. He had a turbo train painted blue and yellow, with the now familiar VIA logo, and operated it *with passengers* — mostly reporters — at a record speed approaching 230 kilometres per hour over a measured mile on a run from Montreal to Kingston. The promotion was a media success.

VIA Rail Canada Inc. was incorporated in January 1977 as a reorganization within Canadian National Railways. Within a matter of months the government had adopted the VIA Rail concept and organization, and the corporation was formally purchased from CN for $100,000 as of December 1977.[3]

*Figure 1*

*VIA Rail Network and Related Routes, 1990*


Réseau VIA Network
1990
Corridor
Transcontinental
(3/Week - 3/semaine)
Regional/Régional
Rocky Mountaineer
Le Montagnard des Rocheuses
Mandatory/Remote
Obligatoire/régions éloignées

**Source: VIA Rail's 1990 network map as revised by authors.**

Canada's national railway passenger corporation (VIA) inherited most of the nation's passenger operations when the federal government relieved Canadian National Railways and Canadian Pacific Limited of the responsibility for these services. Unlike the passenger railways of other countries, including the Amtrak system, VIA Rail (route map illustrated on Figure 1) does not own or operate a major track system.

Creation of VIA Rail was promoted as heralding a new era of improved passenger rail services. VIA took over all existing CN and CP intercity services with the exception of minor Newfoundland mixed trains (combined passenger and freight) and one mixed train in Alberta. The organizational separation, that led to VIA Rail as a railway passenger Crown corporation in December 1977, was initially upbeat, but soon became a less pleasant divorce. More than a decade later, disputes persist over how much VIA should pay, particularly to CN, for equipment and services and for use of the stations and tracks.

## 2. VIA RAIL'S PERFORMANCE

### 2.1 VIA'S PERFORMANCE 1980–1989

Table 1 summarizes VIA's financial and operational results from 1979 through 1991. For comparison purposes, this study has focussed on 1980 through 1989, 1980 being the first year in which VIA had full responsibility for operation of most passenger trains in Canada, and 1989 being the last year before the significant downsizing of VIA's network and operations disrupted the data time series.

During the 1980s, annual passenger volumes dropped 15 to 20 percent from 7.6 million to 6.4 million. Passenger-kilometres dropped by 21 percent over the same period, reflecting shorter average trip lengths. To a large extent, this can be attributed to a progressive reduction in the number and extent of routes offered; total train-kilometres dropped by 16 percent over the same period. A measure of passenger density, average passenger-kilometres per train-kilometre, fell from a high of 127 in 1980 to 119 in 1989. While train-kilometres had fallen by only 16 percent, car-kilometres fell by 31 percent since 1980, reflecting a decreasing use of non-revenue train space and an increasing use of higher-capacity cars. With the exception of 1989, when the average rose to 59 percent, load factors have been reasonably constant in the 50 to 53 percent range.

On the financial side, passenger revenues increased by 74 percent (not adjusted for inflation) but have remained steady in constant dollars. The average "service" revenue per passenger-kilometre, however, increased 31 percent *in real terms* between 1980 and 1989. This reflects a combination of real fare increases and a changing product mix. Non-passenger revenues increased substantially but remained small.[4]

Operating expenses have followed the same general pattern, increasing 69 percent before inflation. Even after inflation, VIA's total operating expenses increased slightly despite the decline in passenger volume and workloads. In real terms, the expenses per passenger-kilometre have increased by 30 percent; per train-kilometre by 22 percent and per car-kilometre by 48 percent. The reasons for these increasing unit costs are varied. Among them:

- the presence of economies of scale/scope and "fixed" costs in the railway industry such that costs do not change in proportion to changes in ridership;
- improvements in the level of service and reliability of operation, especially the on-time performance of trains;
- steadily increasing maintenance and servicing requirements of older passenger cars and locomotives;
- the gradual transfer of functions, assets and employees from the operating railways to VIA. The transfer process has resulted in significant organization and training costs which should be a temporary rather than a permanent cost;[5] and
- abrupt changes in the network and services offered due to government-mandated service cuts and restoration which have interfered with the long-run planning process.

The net result is that VIA's operating deficit has grown from $319 million in 1980 to $527 million in 1989. In real (current dollar) terms, the increase is relatively small — only 5 percent in 10 years. However, given the decline in traffic, the real operating deficit per passenger-kilometre increased by 27 percent between 1980 and 1989, despite a substantial increase in revenue per passenger-kilometre. VIA's level of cost recovery has been stagnant through the 1980s, ranging between 28 and 32 percent with no discernible long-term trend toward improvement.

*Table 1*

**VIA HISTORICAL PERFORMANCE DATA, 1980–1991**

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Traffic/Operating** | | | | | | | | | | | | |
| Total route-km ('000) | 28.9 | 23.7 | na | 23.2 | 24.0 | 25.1 | 24.7 | 24.5 | 24.5 | 24.5 | 16.6 | 16.6 |
| Unique route-km ('000) | 22.6 | 18.7 | na | 18.4 | 19.5 | 19.9 | 19.5 | 19.4 | 19.4 | 19.4 | 13.5 | 13.5 |
| Passengers ('000) | 7,586 | 7,809 | 6,849 | 6,541 | 6,770 | 7,034 | 6,286 | 5,865 | 6,415 | 6,457 | 3,536 | 3,633 |
| Passenger-km (M) | 3,104 | 3,011 | 2,447 | 2,411 | 2,379 | 2,483 | 2,261 | 2,093 | 2,299 | 2,442 | 1,263 | 1,320 |
| Average employees | 4,200 | 4,135 | 3,640 | 3,474 | 3,653 | 4,178 | 5,370 | 5,726 | 6,873 | 6,584 | 4,663 | 4,477 |
| Train-km (M) | 24 | 24 | 20 | 20 | 20 | 21 | 21 | 20 | 20 | 20 | 10 | 10 |
| Car-km (M) | 164 | 161 | 127 | 115 | 116 | 123 | 119 | 108 | 116 | 114 | 58 | 58 |
| **Financial (Current $)** | | | | | | | | | | | | |
| Passenger revenue ($M) | 140 | 165 | 162 | 173 | 177 | 201 | 204 | 195 | 220 | 244 | 139 | 144 |
| Other revenue ($M) | 0 | 3 | 17 | 21 | 24 | 4 | 5 | 2 | 3 | 4 | 4 | 6 |
| Operating expense ($M) | 459 | 581 | 602 | 642 | 595 | 725 | 689 | 696 | 790 | 775 | 540 | 524 |
| Operating deficit ($M) | 319 | 413 | 423 | 448 | 394 | 519 | 480 | 499 | 566 | 527 | 397 | 373 |
| Cost recovery ratio | 0.31 | 0.29 | 0.30 | 0.30 | 0.34 | 0.28 | 0.30 | 0.28 | 0.28 | 0.32 | 0.26 | 0.29 |
| Capital expenditures ($M) | 90 | 109 | 114 | 135 | 154 | 154 | 93 | 81 | 126 | 61 | 31 | 40 |
| Government funding ($M) | 408 | 521 | 535 | 598 | 473 | 631 | 506 | 536 | 637 | 532 | 441 | 393 |
| Government funding (%) | 74% | 76% | 75% | 75% | 70% | 75% | 71% | 73% | 74% | 68% | 73% | 71% |
| Deficit per pass-km (¢) | 10.3 | 13.7 | 17.3 | 18.6 | 16.6 | 20.9 | 21.2 | 23.8 | 24.6 | 21.6 | 31.4 | 28.3 |
| **Indicators (Current $)** | | | | | | | | | | | | |
| Pass-km/employee ('000) | 739 | 728 | 672 | 694 | 651 | 594 | 421 | 365 | 334 | 371 | 271 | 295 |
| Pass-km/route-km ('000) | 138 | 161 | na | 131 | 122 | 125 | 116 | 108 | 117 | 124 | 94 | 98 |
| Train-km/route-km ('000) | 1,084 | 1,269 | na | 1,069 | 1,010 | 1,046 | 1,076 | 1,011 | 1,022 | 1,039 | 759 | 745 |
| Passenger-km/train-km | 127 | 127 | 123 | 123 | 121 | 119 | 108 | 107 | 114 | 119 | 123 | 131 |
| Average trip length (km) | 409 | 386 | 357 | 369 | 351 | 353 | 360 | 357 | 358 | 378 | 357 | 363 |
| Load factor (%) | 53% | 51% | 50% | 53% | 52% | 52% | 51% | 52% | 52% | 59% | 57% | 58% |

*Table 1 (cont'd)*

## VIA HISTORICAL PERFORMANCE DATA, 1980–1991

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Revenue/pass-km (¢) | 4.4 | 5.3 | 6.4 | 7.0 | 7.3 | 7.9 | 8.8 | 9.0 | 9.1 | 9.5 | 10.6 | 10.9 |
| Operate cost/pass-km (¢) | 14.8 | 19.3 | 24.6 | 26.6 | 25.0 | 29.2 | 30.5 | 33.3 | 34.4 | 31.7 | 42.7 | 39.7 |
| Deficit/passenger-km (¢) | 10.3 | 13.7 | 17.3 | 18.6 | 16.6 | 20.9 | 21.2 | 23.8 | 24.6 | 21.6 | 31.4 | 28.3 |
| Operating cost/car-km ($) | 2.8 | 3.6 | 4.8 | 5.6 | 5.1 | 5.9 | 5.8 | 6.4 | 6.8 | 6.8 | 9.4 | 9.1 |
| Operate cost/train-km ($) | 18.8 | 24.5 | 30.2 | 32.7 | 30.3 | 34.8 | 32.8 | 35.5 | 39.3 | 37.9 | 52.7 | 52.1 |
| Depreciation as % of cost | 2% | 2% | 4% | 4% | 6% | 6% | 9% | 8% | 7% | 7% | 8% | 8% |
| RRy payments as % of cost | na | 64% | 62% | 62% | 61% | 59% | 37% | 29% | 14% | 12% | na | na |
| **Indicators (Constant 1990 $)** | | | | | | | | | | | | |
| Revenue/passenger-km (¢) | 7.6 | 8.3 | 9.0 | 9.3 | 9.2 | 9.7 | 10.3 | 10.2 | 10.0 | 9.9 | 10.6 | 10.4 |
| Operate cost/pass-km (¢) | 25.4 | 29.8 | 34.5 | 35.1 | 31.7 | 35.7 | 35.9 | 37.7 | 37.5 | 33.1 | 42.7 | 37.9 |
| Deficit/passenger-km (¢) | 17.6 | 21.2 | 24.2 | 24.5 | 21.0 | 25.6 | 25.0 | 27.0 | 26.9 | 22.5 | 31.4 | 27.0 |
| Operating cost/car-km ($) | 4.8 | 5.6 | 6.7 | 7.3 | 6.5 | 7.2 | 6.8 | 7.3 | 7.4 | 7.1 | 9.4 | 8.7 |
| Operating cost/train-km ($) | 32.3 | 37.9 | 42.3 | 43.2 | 38.4 | 42.6 | 38.7 | 40.3 | 42.8 | 39.5 | 52.7 | 49.7 |

**Notes:** Financial data taken from VIA annual reports. The most recent restated data have been used.
Route-km approximated from year-end timetables and rounded to nearest 25 km.
"Government funding" is sum of operating contract revenues plus capital advances.
Funding includes $59.7 million for labour protection in 1990 and $24.7 million in 1991, not reflected in funding percentage.
Prior to 1988, government contract revenue included an allowance for depreciation.
$161 million in labour protection costs due to restructuring is not included in 1989 operating expenses.
Depreciation is included in expenses in calculation of cost recovery ratio. Starting in 1991, VIA excluded depreciation.
"Revenue per passenger-km" is net of tour revenue.
"CN/CP Payments" include only money paid to CN and CP for train operations.
"Constant dollar" conversions based on the GDP Deflator published by Statistics Canada.
Distance data originally reported in miles; converted to km.
M = million

Over this period, VIA incurred a total of $4.6 billion in operating deficits. Net capital expenditures totalled $1.2 billion.

## 2.2 PERFORMANCE CHANGES 1989–1991

At the beginning of 1990, VIA — under instructions from the federal government — underwent a significant downsizing which included a 30 percent reduction in the extent of VIA's network and a 50 percent reduction in the number of train-kilometres operated. The downsizing included both the elimination of many services and the reduction in frequency on other services. Only the remote services were unaffected by the service cuts.

The immediate results of these changes included a 46 percent reduction in ridership — although this translated into only a 43 percent reduction in revenues. Operating expenses dropped — but only by 30 percent. Thus VIA was able to reduce its operating deficit by some $170 million. The downsizing did nothing to improve *relative* financial performance: cost recovery fell from 32 percent to 26 percent while the deficit per passenger-kilometre increased by 40 percent in real terms. The reasons for this are varied.

- The very poorly performing remote services became a larger part of VIA's overall portfolio.
- VIA's long-distance trains switched to a three-day-per-week schedule, which is less expensive in total, but much less efficient than the previous daily operation.
- Many of VIA's overhead and shared facility costs could not be adjusted downwards as fast as the reductions in train services and ridership. In fact, the cost of some functions could be reduced only by the same amount as the reduction in service.
- Ridership on some routes dropped more than expected given the change in service levels between 1989 and 1990.

In 1991, revenues and ridership recovered somewhat from 1990 levels. Operating expenses were reduced slightly. Thus VIA was able to post a 29 percent cost recovery — about the average for the 1980s. The deficit per passenger-kilometre was reduced by 14 percent in real terms from the 1990 level but still remained some 20 percent higher than the level achieved in 1989.

VIA continues to undertake programs to improve operational efficiency and to regain lost ridership. Thus it is not clear if the financial results for 1991 are indicative of the long-term, post-restructuring situation, even allowing for "new" initiatives. It is clear, however, that overall financial performance has suffered as a result of the service cuts.

## 2.3 1989 PERFORMANCE BY SERVICE

In 1989, before the restructuring and cutbacks, VIA offered nearly 40 different passenger train services.[6] The financial results for these services are summarized in Table 2. The costs reported in Table 2 must be viewed with caution since these data represent only costs which are deemed by VIA Rail to be avoidable with specific train services, and there is a great deal of arbitrariness and latitude for interpretation here. Avoidable costs (as attributed by VIA)[7] accounted for only 58 percent of VIA's operating expenses in 1989.

The services were divided into a number of service groupings.

### Western Interprovincial

Services in 1989 included a daily train from Montreal/Toronto (joining in Sudbury) to Vancouver; a daily train between Winnipeg and Vancouver and thrice weekly service to Prince Rupert. The latter service connected with the Winnipeg–Vancouver train at Jasper and provided service to some "remote" areas in northern British Columbia. Western trips tend to be a blend of long and short journeys. The western services recovered about half of "avoidable" costs. In 1991, western service was limited to a single Toronto–Winnipeg–Edmonton–Vancouver train operating three days per week.

### Eastern Interprovincial

In 1989 eastern services consisted of a daily train between Montreal and Halifax via Saint John and a daily train from Montreal via Campbellton to Moncton where it connected with the Halifax train. Through connections were provided, three days a week, to Gaspé from the Moncton train. Although markets and revenue yields are weaker in the East than in the West, the eastern services recovered just over half of "avoidable" costs in 1989. In 1991, there was three-days-per-week service on the Montreal–Saint John–Halifax, the Montreal–Campbellton–Halifax and the Montreal–Gaspé routes.

Table 2

1989 VIA RESULTS BY SERVICE

| | See Appendix A, notes to specific line entries | Route-km | Daily trains | Best trip time | Pass-trips ('000) | Pass-km ('000) | Load factor (%) | Train-km ('000) | Cars per train | Avg. pass-trip (km) |
|---|---|---|---|---|---|---|---|---|---|---|
| Montreal–Quebec (South Shore) | | 272 | 3* | 3:20 | 262 | 64,001 | 45 | 763 | 3.0 | 244 |
| Montreal–Ottawa | | 187 | 4* | 2:00 | 317 | 55,902 | 50 | 555 | 3.5 | 176 |
| Montreal–Toronto | | 539 | 6 | 4:30 | 1,204 | 493,534 | 62 | 2,414 | 5.7 | 410 |
| Toronto–Ottawa | | 446 | 4 | 3:59 | 505 | 163,564 | 54 | 1,207 | 3.8 | 324 |
| Toronto–Kingston | | 254 | 1* | 2:45 | 64 | 11,674 | 44 | 158 | 2.8 | 182 |
| Mtl–Ott–Tor | | | | | 2,090 | 724,675 | 59 | 4,334 | 4.8 | 347 |
| Toronto–Windsor | | 359 | 4 | 4:10 | 783 | 174,878 | 53 | 1,125 | 5.1 | 223 |
| Toronto–Sarnia | 1,2 | 280 | 5 | 3:00 | 589 | 81,567 | 43 | 834 | 3.7 | 138 |
| Toronto–London | 1 | 185 | 4* | 2:05 | 307 | 37,474 | 45 | 467 | 3.0 | 122 |
| Toronto–Niagara Falls | 3 | 132 | 3 | 1:55 | 266 | 28,368 | 52 | 290 | 3.7 | 107 |
| SW Ontario | | | | | 1,945 | 322,286 | 49 | 2,175 | 4.2 | 166 |
| **Corridor subtotal** | | | | | 4,297 | 1,110,961 | 55 | 7,812 | 4.4 | 259 |
| Moncton–Montreal (Ocean) | 4 | 1,047 | 1 | 15:45 | 218 | 94,802 | 60 | 760 | 7.6 | 435 |
| Gaspé–Montreal | 4 | 1,052 | 3/wk | 16:30 | 66 | 49,700 | 49 | 237 | 4.8 | 753 |
| Halifax–Montreal (Atlantic) | | 1,210 | 1 | 20:40 | 267 | 159,889 | 68 | 879 | 9.5 | 599 |
| **Eastern subtotal** | | | | | 551 | 304,390 | 61 | 1,875 | 9.5 | 552 |
| Toronto/Montreal–Vancouver | 5 | 4,645 | 1 | 75:05 | 631 | 618,258 | 82 | 3,673 | 9.3 | 980 |
| Winnipeg–Vancouver | 6 | 2,508 | 1 | 39:40 | 208 | 206,986 | 69 | 1,811 | 6.6 | 995 |
| Jasper–Prince Rupert | 6 | 1,160 | 3/wk | 21:55 | 27 | 19,272 | 48 | 354 | 4.8 | 714 |
| **Western subtotal** | | | | | 866 | 844,516 | 78 | 5,837 | 8.2 | 975 |

*Table 2 (cont'd)*

## 1989 VIA RESULTS BY SERVICE

| | See Appendix A, notes to specific line entries | Route-km | Daily trains | Best trip time | Pass-trips ('000) | Pass-km ('000) | Load factor (%) | Train-km ('000) | Cars per train | Avg. pass-trip (km) |
|---|---|---|---|---|---|---|---|---|---|---|
| Montreal–Jonquière | | 496 | 3/wk | 8:55 | 27 | 5,959 | 24 | 154 | 3.3 | 221 |
| Montreal–Senneterre | | 703 | 3/wk | 13:00 | 38 | 9,712 | 23 | 214 | 5.9 | 256 |
| Winnipeg–Capreol | | 1,498 | 3/wk | 22:15 | 48 | 12,003 | 22 | 465 | 2.8 | 250 |
| Senneterre–Cochrane | | 296 | 3/wk | 5:35 | 4 | 510 | 11 | 64 | 2.1 | 128 |
| Sudbury–White River | | 484 | 3/wk* | 8:20 | 10 | 1,379 | 17 | 143 | 1.4 | 138 |
| Winnipeg–Churchill | | 1,697 | 3/wk | 34:35 | 43 | 19,594 | 33 | 518 | 5.2 | 456 |
| Wabowden–Churchill | 7 | 702 | 1/wk | two days | 0 | 63 | 4 | 0 | 1.0 | n.a. |
| The Pas–Lynn Lake | 8 | 389 | 3/wk | 10:05 | 8 | 1,519 | 22 | 39 | 6.0 | 190 |
| **Remote subtotal** | | | | | 178 | 50,739 | 25 | 1,598 | 4.0 | 285 |
| Halifax–Sydney | | 473 | 8/wk | 5:49 | 115 | 31,994 | 51 | 439 | 2.3 | 278 |
| Halifax–Yarmouth | | 348 | 1 | 5:35 | 58 | 10,128 | 39 | 253 | 1.6 | 175 |
| Halifax–Moncton–Saint John | | 449 | 1* | 6:00 | 49 | 9,803 | 31 | 317 | 1.8 | 200 |
| Moncton–Campbellton | | 301 | 1* | 3:30 | 29 | 5,929 | 35 | 214 | 1.3 | 204 |
| Moncton–Edmundston | | 372 | 3/wk | 5:30 | 10 | 3,009 | 33 | 116 | 1.3 | 301 |
| Quebec–Mont Joli | | 357 | 1* | 5:15 | 37 | 7,097 | 19 | 246 | 2.1 | 192 |
| Mtl–Trois Rivières–Quebec | | 277 | 2 | 3:30 | 36 | 8,224 | 28 | 486 | 1.0 | 228 |
| Montreal–Sherbrooke | | 159 | 1* | 2:10 | 20 | 2,028 | 39 | 89 | 1.0 | 101 |
| Toronto–Havelock | | 163 | 1 | 2:43 | 44 | 4,118 | 28 | 116 | 1.9 | 94 |
| Toronto–North Bay | 9 | 367 | 9/wk | 4:45 | 66 | 20,954 | 46 | 328 | 4.0 | 317 |
| Cochrane–Kapuskasing | 9 | 111 | 1 | 1:53 | 7 | 769 | 15 | 77 | 2.0 | 110 |
| Victoria–Courtenay | | 225 | 6/wk | 4:00 | 50 | 7,236 | 50 | 161 | 1.4 | 145 |
| **Regional subtotal** | 10 | | | | 521 | 111,288 | 37 | 2,842 | 1.9 | 214 |
| **Rocky Mountaineer** | | | seasonal* | | 15 | 13,887 | 74 | 56 | 6.5 | 926 |
| **Grand total** | | | | | **6,428** | **2,435,782** | **59** | **20,020** | **5.6** | **379** |

**Note:** n.a. = not available

*Table 2 (cont'd)*

### 1989 VIA RESULTS BY SERVICE

| | Route density pkm/rkm ('000) | Service revenue ($'000) | Avoidable cost ($'000) | Avoidable cost recovery (%) | Revenue per pass-km (¢) | Avoidable cost/pass-km (¢) | Status after 1990 restructuring |
|---|---|---|---|---|---|---|---|
| Montreal–Quebec (South Shore) | 235 | 7,546 | 16,287 | 46 | 9.9 | 25.4 | Retained |
| Montreal–Ottawa | 299 | 6,164 | 12,781 | 48 | 10.6 | 22.9 | Retained at 3/day, now 4 |
| Montreal–Toronto | 915 | 48,375 | 69,835 | 69 | 9.5 | 14.1 | Retained at 5/day, now 6 |
| Toronto–Ottawa | 367 | 17,568 | 25,423 | 69 | 10.6 | 15.5 | Retained at 3/day, now 4 |
| Toronto–Kingston | 46 | 1,159 | 2,125 | 55 | 9.9 | 18.2 | Discontinued |
| Mtl–Ott–Tor | | 73,266 | 110,164 | 67 | 9.8 | 15.2 | |
| Toronto–Windsor | 487 | 18,814 | 27,083 | 69 | 10.7 | 15.5 | Retained |
| Toronto–Sarnia | 291 | 8,657 | 15,513 | 56 | 10.6 | 19.0 | Retained at 2/day |
| Toronto–London | 202 | 4,254 | 8,015 | 53 | 11.3 | 21.4 | Daily (prov. support) |
| Toronto–Niagara Falls | 215 | 3,346 | 5,786 | 58 | 10.3 | 20.4 | Retained at 3/day |
| SW Ontario | | 35,071 | 56,397 | 62 | 10.7 | 17.5 | |
| **Corridor subtotal** | | 115,883 | 182,848 | 63 | 10.1 | 16.5 | |
| Moncton–Montreal (Ocean) | 91 | 7,890 | 18,530 | 43 | 8.3 | 19.5 | 3/wk through to Halifax |
| Gaspé–Montreal | 47 | 4,529 | 7,401 | 61 | 9.0 | 14.9 | Retained as separate train |
| Halifax–Montreal (Atlantic) | 132 | 14,081 | 25,194 | 56 | 8.5 | 15.8 | Retained at 3/wk |
| **Eastern subtotal** | | 26,500 | 50,388 | 53 | 8.5 | 16.6 | |
| Toronto/Montreal–Vancouver | 133 | 53,738 | 98,782 | 54 | 7.9 | 16.0 | 3/wk ex Toronto via CN |
| Winnipeg–Vancouver | 83 | 17,284 | 42,398 | 41 | 7.7 | 20.5 | Discontinued |
| Jasper–Prince Rupert | 17 | 1,700 | 7,387 | 23 | 7.8 | 38.3 | Retained |
| **Western subtotal** | | 72,722 | 148,567 | 49 | 7.8 | 17.6 | |

*Table 2 (cont'd)*

**1989 VIA RESULTS BY SERVICE**

| | Route density pkm/rkm ('000) | Service revenue ($'000) | Avoidable cost ($'000) | Avoidable cost recovery (%) | Revenue per pass km (¢) | Avoidable cost/ pass km (¢) | Status after 1990 restructuring |
|---|---|---|---|---|---|---|---|
| Montreal–Jonquière | 12 | 557 | 2,529 | 22 | 8.7 | 42.4 | Retained |
| Montreal–Senneterre | 14 | 963 | 4,357 | 22 | 9.9 | 44.9 | Retained |
| Winnipeg–Capreol | 8 | 1,039 | 8,121 | 13 | 8.5 | 67.7 | Served by Interprovincial |
| Senneterre–Cochrane | 2 | 67 | 1,009 | 7 | 9.4 | 197.8 | Service cut back |
| Sudbury–White River | 3 | 136 | 963 | 14 | 9.9 | 69.8 | Retained |
| Winnipeg–Churchill | 12 | 2,527 | 12,057 | 21 | 9.9 | 61.5 | Retained |
| Wabowden–Churchill | n.a. | 5 | 59 | 8 | 8.0 | 94.0 | Retained |
| The Pas–Lynn Lake | 4 | 146 | 978 | 15 | 9.3 | 64.4 | Retained |
| **Remote subtotal** | | 5,440 | 30,073 | 18 | 9.4 | 59.3 | |
| Halifax–Sydney | 68 | 2,242 | 6,034 | 37$ | 7.0 | 18.9 | Discontinued |
| Halifax–Yarmouth | 29 | 882 | 2,573 | 34 | 8.6 | 25.4 | Discontinued |
| Halifax–Moncton–Saint John | 22 | 781 | 3,470 | 23 | 8.0 | 35.4 | Discontinued |
| Moncton–Campbellton | 20 | 510 | 1,828 | 28 | 8.6 | 30.8 | Discontinued |
| Moncton–Edmunston | 8 | 232 | 888 | 26 | 7.7 | 29.5 | Discontinued |
| Quebec–Mont Joli | 20 | 584 | 2,804 | 21 | 8.2 | 39.5 | Discontinued |
| Mtl–Trois Rivières–Quebec | 30 | 712 | 3,159 | 23 | 7.5 | 38.4 | Discontinued |
| Montreal–Sherbrooke | 13 | 188 | 722 | 26 | 9.3 | 35.6 | Discontinued |
| Toronto–Havelock | 25 | 504 | 1,376 | 37 | 12.2 | 33.4 | Discontinued |
| Toronto–North Bay | 57 | 2,297 | 5,863 | 39 | 10.6 | 28.0 | Discontinued |
| Cochrane–Kapuskasing | 7 | 117 | 1,171 | 10 | 14.7 | 152.2 | Discontinued |
| Victoria–Courtenay | 32 | 738 | 1,440 | 51 | 8.2 | 19.9 | Retained (court case) |
| **Regional subtotal** | | 9,787 | 31,328 | 31 | 8.5 | 28.2 | |
| **Rocky Mountaineer** | | 6,614 | 5,506 | 120 | 47.6 | 39.6 | Sold to private operator |
| **Grand total** | | **236,946** | **448,710** | **53** | **9.2** | **18.4** | |

**Note: See Appendix A, Notes to VIA Route Specific Data**
**n.a. = not available**

### Montreal–Ottawa–Toronto Corridor (M–O–T)

A number of departures that constitutes a reasonable intercity option for travellers, and travel times comparable with or better than the car, are provided between Montreal and Ottawa, Ottawa and Toronto, and Toronto and Montreal using VIA's newer LRC equipment (the cars, not generally the locomotives). Ridership in this group increased in recent years as a result of various service and marketing initiatives. M–O–T services account for nearly a third of VIA's total ridership (passengers and passenger/kilometres) and recover approximately two thirds of "avoidable" costs from passenger revenues.

### Southwestern Ontario

Considered by VIA as part of the M–O–T corridor, four routes are served westbound from Toronto. Trip distances tend to be short (averaging 166 kilometres) reflecting a long-distance commuter and day-trip market. Revenues from southwestern Ontario covered 62 percent of "avoidable" costs. Ridership was nearly one third of VIA's total.

### Regional Services

For the most part, regional services consisted of short (one- or two-car) trains operating once a day offering either a "commuter-like" service into regional centres or supplementary service on lines served by transcontinental trains. Ridership on many regional services has been stagnant or declining in recent years. While there were notable exceptions for individual routes as a whole, VIA's regional services recovered less than a third of "avoidable" costs. For the most part, regional services had been eliminated by 1991.

### Remote Services

VIA operates eight[8] train services through "remote" areas where, for some of the run, there is no other ground transportation available. Service varies from long, overnight trains (Winnipeg–Churchill) to short, mixed trains (Lynn Lake). Load factors and passenger density tend to be low, resulting in "avoidable" cost recovery ranging between 7 and 22 percent. There are two points worth noting with respect to remote services:

- Generally only a portion of the route is truly without alternate transportation.

- In some cases, a long-distance train (incidentally) provides services to remote communities which, in the 1970s, were served by a separate, short-distance train.[9]

## 2.4 OTHER RAIL PASSENGER SERVICES AND FINANCIAL RESULTS COMPARED WITH VIA

Regular intercity and rural rail passenger services are also offered by six other railways. These services account for less than 5 percent of the total Canadian intercity and rural railway passenger market. In the case of provincially owned railways, subsidies are provided by the provincial government. In the case of federally chartered railway carriers, a subsidy of 80 percent of the actual loss (based on long-run variable cost, including an allowance for capital) is provided by the Government of Canada under section 270 of the *Railway Act*, a process unchanged from the *National Transportation Act* of 1967. While there are differences in funding arrangements, the financial performance of these services is not significantly different from similar services offered by VIA.

The **Algoma Central Railway** (ACR) provides service between Sault Ste Marie and Hearst (476 kilometres) six days per week during the summer and three days per week during the winter. Most of this route is without road access. Ridership is approximately 40,000 annually — about 45 percent tour passengers. Revenues cover about 25 percent of costs. For 1987 the ACR received $2.3 million in federal subsidies under section 270. The ACR also operates a number of separate tour trains with annual ridership on the order of 100,000. Tour revenues cover incremental operating costs but do not provide sufficient net income for reinvestment in equipment or to cover any significant allocation of fixed costs. Passenger trains — including government subsidies — account for one fifth of the ACR's receipts. Declining freight revenues have resulted in the passenger system having to bear an increasing proportion of maintenance and administrative costs and in significant financial difficulties for the ACR. Over a five-year period starting in 1987, the ACR was paid a total of $15 million under the terms of a joint federal–provincial agreement designed to "continue its non-passenger rail services." In the 1990s, the ACR received other provincial subsidies as well.

Rail passenger service is a minor part of the provincially owned **British Columbia Railway** (BCR) with passenger revenues being less than 1 percent of freight revenues. The BCR offers daily service between North Vancouver and Lillooet (254 kilometres). Trains continue through to Prince George (490 kilometres) three days per week (daily during the peak period). In 1987, 79,000 passengers were carried, and there has been significant revenue/ridership growth in subsequent years. The BCR attributes over half of its ridership to tour groups. Specific provincial funding contributions to the rail passenger operations has grown from $2.1 million in 1985 to $3.3 million in 1990.[10] The province has also provided separate capital funding totalling $5 million between 1985 and 1990 for the BCR to rebuild its passenger fleet.

Until the beginning of 1990, **Canadian National** operated a weekly mixed train service between Edmonton and Waterways (Fort McMurray), Alberta. In 1987, federal subsidy payments for this service were approximately $310,000.

In 1987, the **Ontario Northland Railway** (owned by the Province of Ontario) handled 130,000 intercity passengers with weekday service between Toronto and Timmins (784 kilometres), daily overnight service between Toronto and Cochrane (776 kilometres),[11] and thrice weekly mixed train service in the remote area between Cochrane and Moosonee (300 kilometres). The ONR also provides daily tour train service between Cochrane and Moosonee during the summer with ridership of 20,000 to 25,000. Passenger activity accounted for about one quarter of the ONR's railway operations. In 1987, provincial operating subsidies (based on fully allocated costs) totalled $11.2 million for the passenger operations[12] plus $8.4 million for the total operation of the Moosonee branch line (freight and passenger combined). The province also provides capital funding as required, and the company has spent $25 million in recent years building a fleet of modern passenger cars.

The **Quebec North Shore and Labrador Railway** (QNS&L) provides twice weekly mixed train service from Sept-Îles to the Schefferville/Labrador City area (about 600 kilometres of remote area). In 1987, the federal government provided $1.14 million — representing about 1 percent of company revenues — in section 270 payments for this service.

**Amtrak**, the United States national rail passenger corporation, offers one train a day from Toronto to Chicago via Sarnia and from Toronto to New York via Niagara Falls. These trains are operated jointly with VIA, and the statistics are included in those of the respective companies (Table 2 and Table 10). Amtrak also offers two trains per day between Montreal and

New York/Washington. These trains are operated in Amtrak's own name, and it purchases support services from VIA and from CN. No Canadian subsidies are paid for Amtrak's Montreal services.

In addition to intercity rail passenger, there are two major suburban commuter systems operated by the railways in Canada:

- *Montreal Urban Community Transportation Commission:* The Commission provides commuter service on a number of routes in the Montreal area using CN and CP facilities. These services — which do not qualify for section 270 payments — were formerly operated by the two railways at a loss. The federal government subsidizes capital assets for the Montreal commuter services.

- *GO Transit:* The Ontario government provides urban and short-distance intercity service in the vicinity of Toronto. Although GO owns some track, for the most part, their trains operate over the tracks of CP and CN. In addition to track access, both railways provide various other services to GO under contract. It is of interest to note that some of GO's services have replaced services provided by VIA in its early years. There are no federal subsidies for these services.

Table 3 compares the 1987[13] financial results of the four Class II regional railways offering intercity passenger service to the results for VIA.[14]

*Table 3*

*FOUR CLASS II RAILWAYS AND VIA: FINANCIAL RESULTS, 1987*

| | | VIA | ACR | BCR | ONR | QNS&L |
|---|---|---|---|---|---|---|
| Passengers | *('000)* | 5,865 | 40 | 79 | 132 | 19 |
| Passenger-km | *('000)* | 2,092,628 | 8,967 | 18,159 | 53,622 | 5,429 |
| Passenger revenue | *($'000)* | 197,602 | 927 | 1,616 | 4,207 | n.a. |
| "Operating" subsidy | *($'000)* | 498,524 | 2,284 | 2,450 | 15,893 | 958 |
| Revenue per passenger-km | *(cents)* | 9.4 | 10.3 | 8.9 | 7.8 | n.a. |
| Subsidy per passenger-km | *(cents)* | 23.8 | 25.5 | 13.5 | 29.6 | 17.6 |
| Cost recovery | *(ratio)* | 0.28 | 0.25 | 0.40 | 0.21 | n.a. |
| Government funding | *(percent)* | 72 | 60 | 60 | 79 | n.a. |
| Railway funding | *(percent)* | — | 15 | — | — | n.a. |

**Source:** **Commission estimates based on data in railway annual reports and *Jane's World Railways*.**

**Note:** **n.a. = not available**

On the basis of the data, it is clear that the cost structure of the BCR is quite low, as evidenced by the 13-cent per passenger-kilometre subsidy level. This appears to be the result of using modern equipment, an efficient operation and relatively low station and marketing costs due to the high preponderance of tour passengers. The BCR's revenue per passenger-kilometre is not significantly higher than other railways, and the overall financial performance is on a par with some of VIA's better regional or corridor services. The ONR's subsidy level and government funding percentage is the highest, due in part to the fully allocated nature of the costing, and to the seemingly low revenue base, compared to similar VIA services. The ONR's services have a significant remote component, and the overall level of cost recovery does not appear out of line from those of VIA's remote services. The ACR's operation is essentially a remote service as well, but benefits from a significant tourism component which increases the level of cost recovery. The ACR's 60 percent government funding level, however, can be quite misleading. Unlike the two provincial railways, the ACR must bear at least 15 percent of the calculated passenger train losses; losses which are also calculated on a less inclusive cost base than those for other companies.

## 3. RAIL PASSENGER COST MODEL

While there are considerable historical data that describe the past performance of rail passenger services — at least in terms of direct costs — these data are not appropriate decision variables for the assessment of future performance. The past, however, is important in that it is the base from which productivity improvements and other changes must be analyzed. Similarly, the use of system average values per train-kilometre, car-kilometre, passenger and average overhead burdens allow for an easy analysis, but only result in "accurate" costs being determined for the hypothetical *average* train service or perhaps for the total of the entire railway network. Since individual services differ significantly from the average in terms of train size, utilization, services offered and other attributes, considerable bias would be introduced. By the same token, station facilities must also be examined on a specific basis. The costs of handling the same number of passengers at two terminal stations is significantly different than handling them at a dozen line stations even over the same route.

It was necessary, for the present review, to specify a passenger train costing model which, on the one hand, would provide for ease of analysis, but, on the other, capture the important differences between services. VIA's operating data and costs, that served as a starting point for the present analysis, are given in Appendix B. An explanation, by individual cost element, of the model's cost attribution/allocation procedure is contained in Appendix C. There are five general types of information which are incorporated into the railway costing model:

- service attributes under the *control of management*;
- service attributes dictated by the *nature of the market*;
- changes (improvements) in productivity unrelated to service attributes;
- the allocation of overhead and indirect costs; and
- the incorporation of changes in traffic levels.

Typical service attributes (the first two categories above) would be the route length and location, train frequency, the level of on-board services provided, train length and load factors, type of equipment used (locomotive-hauled cars as opposed to self-propelled cars, new cars versus old cars) and so on. Each element has an impact on costs. For example, a decision to offer diner service adds a requirement for an extra car per train, thus increasing the number of cars required per passenger. As well, the diner itself is often a higher-cost car than one which provides only coach seating. Such cars also require additional staffing.

The distinction between the two types of service attributes is somewhat blurry. To return to the previous example, management always has the prerogative of adding a diner to any train. The nature of the market, however, can be such that management may have no choice but to provide a diner (long-distance, transcontinental trips), or there may be absolutely no reason to contemplate a diner (a 150-kilometre, two-car trip). Nevertheless, train sizes and equipment requirements are attributes which are mainly governed by the market.

Incorporation of service attributes has been handled by specifying a number of service groups[15] with broadly similar characteristics:

- Montreal–Ottawa–Toronto corridor;

- southwestern Ontario;
- western interprovincial;
- eastern interprovincial (Montreal–Maritimes)
- short-distance regionals; and
- remote services.[16]

The service costing is based on VIA's 1990[17] year-end data plus some 1988 cost relationships which were established on the basis of 1988 or 1989 results and converted to 1990 price levels. Thus, the wage rates, work rules and operating conditions currently in force are embedded in the costs. A forward-looking cost model must be able to address the changes which are expected to take place in the coming years. Elements include "normal" cost escalation (not examined in this paper), structural changes in labour practices and different equipment. Such changes are accommodated by altering the specific cost relationships depending on the assumptions for the future. For example, the projected elimination of the second engine driver and a train crew person result in lower average crew costs per kilometre, but *only* for those services or service groups where crew reduction would actually occur.

Overheads and indirect costs are also an important issue. Forty-two percent of VIA's 1988 costs fall into this category. Allocation of these costs is necessary to determine a fully allocated cost. Proper allocation is necessary so as not to bias the estimated financial performance of any group of services at the expense of other sectors. For a number of cost categories, it is possible to attribute some expenses to corresponding service groups (although not to specific train runs). Equipment capital costs are an example of this type of attribution. There still remain some cost elements, general administration for example, which must be allocated on the basis of some notional causal factor, be it related direct costs or related physical measures of output. Care has been taken, however, to ensure that all indirect and overhead costs are not assumed to be fully variable with changes in the scale and scope of operations. Thus, the costs of providing station facilities in the M–O–T corridor, while related to passenger volume, would not be projected to increase by 20 percent given a 20 percent increase in traffic.

Much of the cost impact of changes in ridership is incorporated by the appropriate adjustment of service attributes, in particular train size (both cars *and* locomotives as required) and frequency, if required. Thus, the accommodation of passengers through increasing the load factors results in little additional operational costs. If additional cars are required, but existing trains are sufficient to handle the total projected passenger volume, there is no change in either the crew or a significant part of the track usage fees. Other costs would vary more directly with passenger volumes, for example, credit- card discounts and ticket agency commissions.

It should be noted that fully allocated costs are developed for the present context, and the classical fixed-variable distinction in railway costing is not developed. Thus, if all VIA's service groups are costed, VIA's total expenditures will be attributed to one service group or another. The use of fully allocated costs is sometimes questioned, especially in railway studies, on the grounds that it may mask the fact that the incremental cost per passenger may be significantly different from the average cost, even allowing for long-run adjustments. This should not be a problem in the present context since changes in ridership are addressed directly through specific revenue and cost adjustments, rather than through the use of averages.

## 3.1 TYPICAL MODEL RESULTS

The cost and financial viability prospects estimates development is presented in Table 4 using the Montreal–Ottawa–Toronto (M–O–T) service group as an example. These estimates are also compared with VIA's present results. Other services could be selected for similar treatment but M–O–T has the greatest prospects for viability, and if M–O–T cannot be made viable, the prospects for VIA's other services will not be better.

The costs estimated here and discussed below were derived from and can be related to those reported to the Royal Commission by VIA, but there are a number of significant differences. The most striking difference is the inclusion of full capital charges for the equipment and facilities which are required by the individual services. This results in lower cost recovery rates than reported by VIA. The second major difference is that the present costing attempts to allocate overhead and indirect costs to services in a causal manner. VIA treats such costs as overhead on direct expenditures.

*Table 4*

### COST ESTIMATES DEVELOPMENT: BASED ON VIA DATA MONTREAL–OTTAWA–TORONTO SERVICES (EXAMPLE)

| | | In 1988 $ | In 1990 $ |
|---|---|---|---|
| **1988 VIA data** | Ridership (M) | 2.2 | 2.2 |
| | Revenues ($M) | 69.7 | 75.7 |
| | Avoidable operating costs ($M) | 105.5 | 114.5 |
| | Apparent cost recovery | 66% | 66% |
| | Share of common costs ($M) | 58.2 | 63.2 |
| | Total operating costs ($M) | 163.8 | 177.7 |
| | Cost recovery | 43% | 43% |
| | Total deficit per passenger ($) | 43.11 | 46.77 |
| **1990 VIA data** | Ridership (M) | | 1.6 |
| | Revenues ($M) | | 58.0 |
| | Avoidable operating costs ($M) | | 81.7 |
| | Apparent cost recovery | | 71% |
| | Share of common costs ($M) | | 57.8 |
| | Total operating costs ($M) | | 139.5 |
| | Cost recovery | | 42% |
| | Total deficit per passenger ($) | | 50.80 |
| **Re-estimate of VIA's 1990 results** | Ridership (M) | | 1.6 |
| | Revenues ($M) | | 58.0 |
| | Total operating costs ($M) | | 125.7 |
| | Total recovery | | 46% |
| | Total deficit per passenger ($) | | 42.19 |
| **Estimate of steady-state costs assuming 1990 ridership** | Ridership (M) | | 1.6 |
| | Revenues ($M) | | 58.0 |
| | Total operating costs ($M) | | 115.8 |
| | Total recovery | | 50% |
| | Total deficit per passenger ($) | | 36.02 |
| **Estimate assuming steady-state costs and 25 percent ridership growth** | Ridership (M) | | 2.0 |
| | Revenues ($M) | | 76.2 |
| | Total operating costs ($M) | | 126.8 |
| | Total recovery | | 60% |
| | Total deficit per passenger ($) | | 25.27 |
| **Estimate incorporating cost of capital charges** | Ridership (M) | | 2.0 |
| | Revenues ($M) | | 76.2 |
| | Operating costs ($M) | | 126.8 |
| | Capital charges ($M) | | 19.5 |
| | Total costs ($M) | | 146.3 |
| | Total cost recovery | | 52% |
| | Total deficit per passenger ($) | | 35.01 |

**Note: M = million**

### 1988 VIA Data

For 1988, VIA reported revenues of $70 million and avoidable costs of $105 million for the M–O–T service group. This implies an avoidable cost recovery of 66 percent. Since avoidable costs account for approximately two thirds of VIA's total operating costs on these services, the apparent cost-recovery rate does not give a clear picture. If all other (non-capital) costs are allocated to services in the manner used in VIA's 1989 *Review of Passenger Rail Transportation in Canada (1989 Review)*, total M–O–T costs rise to $163.8 million, implying a cost recovery rate of only 43 percent and a deficit per passenger of $43, on a traffic base of 2.2 million passengers. (The 1988 results are quoted in 1988 price levels. For comparative purposes, 1988 costs and revenues shown in Table 4 are adjusted to 1990 price levels in the right-hand column of the table.)

### 1990 VIA Data

In 1990, VIA reported revenues of $58 million and avoidable costs of $82 million for the sector, with an avoidable cost recovery rate of 71 percent. Inclusion of common costs, using the same procedure as used for 1988, gives a recovery rate of 42 percent and a total deficit of $51 per passenger on a base of 1.6 million passengers. Although 1990 represented a moderate deterioration in relative financial performance, the total deficit for the sector was reduced by $21 million (20 percent).

### Re-estimate

One of the major differences between 1990 and 1988 is the impact of the downsizing of VIA. M–O–T ridership dropped by 27 percent, train sizes were reduced, and one train was discontinued on each route in the sector. It is worth noting that the decrease in revenue appears to be attributable to the decrease in ridership. Only 5 percent of the decline in revenue is attributable to an apparent decrease in the revenue yield per passenger-kilometre. On the cost side, $13 million (in allocated common costs) of the $126 million total operating cost is an increase over that which would have applied had the 1988 avoidable to common relationship applied in 1990. This type of result is to be expected. Using a simple model, the decrease in ridership and operations would have indicated a decrease in total costs of some $45 million (including a proportional change in allocated common costs which did not occur). In addition, it appears that there was some $5 million in efficiency gains in the M–O–T sector attributable to the use of newer locomotives and changes in the way VIA provided service.

Working with the present model and using VIA's reported 1990 ridership and operational data, total costs are estimated to be $126 million. The $14 million difference between VIA data and the estimate developed here can be attributed in a large part to a more service-specific allocation of overheads and other non-direct costs and to a lesser extent to the removal from the cost base of extraordinary catch-up equipment maintenance costs. On this basis, this study estimates that there is a 46 percent cost recovery level for the M–O–T sector with a deficit per passenger of $42. The total deficit attributable to M–O–T is estimated as $68 million, 17 percent lower than that implied from applying the *1989 Review* methodology to VIA's 1990 reported data.

### Estimate of Steady State

The next set of figures in Table 4 represents the incorporation of cost efficiency gains that might be reasonably expected in the short to medium term. These are programs which are presently in place, in the planning stages or which could be readily implemented. Included are crew reductions, improved equipment and reduced overhead. When the 1990 M–O–T sector data is recomputed with these Steady State Costs, total costs drop by some $10 million (8 percent), bringing the forecast cost recovery rate up to 50 percent and the deficit per passenger down to $36. The potential for efficiency gains from new equipment is not as great for the M–O–T sector as for some other sectors since the 1990 data reflect a considerable number of newer F40 locomotives and since the differences between the existing LRC coach and new coaches are not as striking as the differences between the existing conventional cars and new cars.

### Ridership Growth

Thus far, the analysis has been limited to reported 1990 ridership levels. Actual ridership for the first six months of 1991 was 12 percent higher than for the corresponding period in 1990. To accommodate this, the results have been recomputed assuming a steady-state increment of 25 percent in ridership and 5 percent in the average yield.[18] Car-kilometres have been increased so that the load factor is held to an average of 70 percent (from the 1990 actual value of 65 percent). In addition, the equivalent of one additional Ottawa–Toronto train has been assumed.[19] Locomotive-kilometres and other output measures have been adjusted commensurate with the projected new levels of demand, car-kilometres and train-kilometres.

These changes would result in estimated M–O–T revenues of $76 million and total costs of $127 million. Due to the more intensive use of the existing trains and other assets and services, it is estimated that the incremental costs of serving the incremental passenger demand is less than the incremental revenues, resulting in an overall cost recovery rate of 60 percent and a deficit per passenger of $25. Given these cost and ridership assumptions, the total deficit for the M–O–T sector is brought down to approximately $50 million.

The above step in the analysis illustrates an important point with respect to VIA's services: *Ridership is a key element to improved financial performance.* Given existing train services that are not stretched to the limit of capacity, the incremental cost of additional ridership can be quite low in a steady-state environment where good equipment, as opposed to resurrected, old equipment from storage, can be deployed and service provided in an orderly fashion. To be truly viable, however, the additional ridership must be the result of natural growth, aggressive marketing or service quality.

Ticket price discounting as a method of attracting ridership cannot be seen as a quick fix. For example, a 6 percent reduction in the average yield as a means of attracting the additional ridership would dilute total revenue sufficiently that incremental costs would be greater than incremental revenues. The cost recovery percentage would improve, but the total deficit would increase slightly. This example also illustrates the downside effects of decreased ridership — the potential for greater than proportional increases in the deficit.

**Incorporating Cost of Capital**

In addition to the operating costs that have been discussed in the previous steps, there are significant capital costs associated with providing the M–O–T service, many of which are not included in VIA Rail's accounts. Assuming a 10 percent real cost of money and assets being 50 percent depreciated, [illegible] annual capital charge — including depreciation — of nearly $20 million ($10 per passenger) would be applicable to the M–O–T sector.

This includes the valuation of all required rolling stock at approximately 1990 replacement costs, the capital costs of maintenance facilities and other assets. It excludes various sunk capital expenditures such as the upgrading of the Ottawa–Toronto route and upgrading of various major stations. Inclusion of the capital charge brings the prospective total cost recovery down to 52 percent and increases the deficit per passenger to $35.

Including capital charges in this way provides an estimate of revenues that would be required for the operation to be commercially viable on a longer-term basis, particularly when equipment requires replacement. It is also the appropriate measure from the point of view of government, which must supply the capital. In the past, operating costs may have been more appropriate from VIA's perspective, since it received capital funding separately and was not mandatated to recover its costs.

## 4. PROJECTED COST RECOVERY BY SERVICE GROUP

Table 5 shows projections of VIA's costs and financial results for a number of service groups. The costs are fully allocated in the sense that provision is made for functional overheads, general corporate overheads, shared facilities and operations plus the cost of capital on equipment and facilities. The costs are steady-state, that is, allowance has been made for improvements in the cost experience of passenger rail. The cost and revenue numbers represent no specific year in the future, but rather a generic future period, presumably within the 1990s. In particular, it is assumed that modern, efficient equipment is in place, improvements in crewing practices have occurred and VIA has been successful in carrying out a number of projected overhead reduction programs.

Passenger demand and revenues, and train service patterns are based on the 1990 services offered by VIA, but are adjusted from VIA's 1990 experience. In particular, allowance has been made for growth in the market and for a recovery from the transient effects of the 1990 network downsizing.

To aid in the analysis, costs are reported under four headings. *Operations* cost is the actual cost of running trains (crews, fuel, maintenance, track and so on). *Customer services* cover stations, ticketing and marketing. *Administration* costs, as shown here, include the corporate executive and other general administrative functions. Specific administrative expenses for train operations or the marketing system are included in operations or customer service as appropriate. *Capital charges* include depreciation and a 10 percent cost of money, assuming all assets, most importantly equipment, are of new quality (as discussed above) and 50 percent depreciated.

*Table 5*

PROJECTIONS OF VIA COSTS AND REVENUES: SELECTED SERVICES

(BASED ON FULL COSTS ASSUMING STEADY STATE RIDERSHIP, EQUIPMENT AND PRODUCTIVITY, 1990 $)

| | Corridor M–O–T* | Corridor MT–OT* | South-western Ontario | Inter-provincial West | Inter-provincial East | Example Regional Network |
|---|---|---|---|---|---|---|
| Train-km (million) | 3.7 | 3.3 | 2.0 | 1.8 | 1.2 | 1.5 |
| Car-km (million) | 17.2 | 15.4 | 9.6 | 18.6 | 12.3 | 2.6 |
| Cars per train | 4.7 | 4.7 | 4.8 | 10.1 | 10.6 | 1.8 |
| Passengers ('000) | 2,004 | 1,709 | 1,326 | 202 | 297 | 275 |
| Trip length (km) | 351 | 381 | 183 | 1,430 | 716 | 229 |
| Load factor | 70% | 71% | 47% | 79% | 64% | 36% |
| Passenger-km/ train-km | 191 | 200 | 122 | 158 | 183 | 43 |
| Revenue ($ million) | 76 | 69 | 31 | 31 | 19 | 5 |
| Revenue per passenger-km ($) | .11 | .11 | .13 | .11 | .09 | .08 |
| **Costs** ($ million) | | | | | | |
| Operations | 83 | 73 | 44 | 63 | 45 | 14 |
| Customer service | 31 | 28 | 18 | 12 | 10 | 4 |
| Administration | 13 | 11 | 7 | 8 | 6 | 2 |
| Capital charges | 20 | 17 | 15 | 20 | 20 | 5 |
| Total costs | 146 | 130 | 84 | 103 | 81 | 25 |
| Deficit ($ million) | 70 | 61 | 54 | 72 | 62 | 20 |
| Total cost recovery | 52% | 53% | 36% | 30% | 24% | 20% |
| Operating cost recovery | 60% | 61% | 44% | 37% | 31% | 25% |
| Revenue per passenger ($) | 38 | 41 | 23 | 155 | 65 | 19 |
| Total cost per passenger ($) | 73 | 76 | 63 | 511 | 274 | 92 |
| Total deficit per passenger ($) | 35 | 36 | 40 | 356 | 209 | 73 |
| Total deficit per passenger-km ($) | .10 | .09 | .22 | .25 | .29 | .32 |

**Note:** **M–O–T represents the Montreal–Ottawa, Ottawa–Toronto and Montreal–Toronto services.**

**MT–OT represents the Montreal–Toronto and Ottawa–Toronto services.**

Unless specified otherwise, all references to costs, deficits and cost recovery percentages are based on total costs including operations, overheads and capital charges. An operating cost recovery rate has also been included in the table. This value excludes depreciation and capital costs from the calculation and is directly compatible with the type of values which VIA has calculated in its *Corporate Plan.*

## 4.1 WESTERN INTERPROVINCIAL

The western interprovincial services (Toronto to Winnipeg and Winnipeg to Vancouver, plus the Edmonton to Prince Rupert segment) are characterized by long average passenger trips (1,430 kilometres[20]) and a need to provide sleeper cars, diners and other non-revenue cars. This results in higher transportation costs per passenger compared to other services and additional costs that are not recovered through revenues. Load factors are relatively high (79 percent), which reflects the very high demand during the tourist season and the reduction in the train (cars are removed) during the off-peak.

Based on 1990 passenger demand and services, fully allocated, steady-state costs are estimated to be $511 per passenger. Revenues are estimated at $155, resulting in a 30 percent full cost recovery rate.

The relative financial performance (recovery rate and deficit per passenger-kilometre) is influenced by the way the services have been restructured. The Toronto–Vancouver service is provided three times per week on a single route compared with the former daily service over a more extensive route. Three days per week operation of long-distance services, which has been used as a total cost cutting measure for the past two decades, can result in less efficient crew[21] and equipment deployment. The costs of other functions and facilities (especially stations and maintenance points) cannot be scaled down without increases in average costs.[22]

Another factor affecting the financial performance is the service to remote areas which is provided as part of the western interprovincial services. Segments of the route between Capreol and Winnipeg are considered remote and had been served by separate trains. Covering this area by rerouting the main western interprovincial service may result in significant savings to VIA as a whole, but it adds to the cost burden on the interprovincial service group. Similarly, revenues and ridership on the Prince Rupert segment (which also features "remote" areas) are much lower than the average in the West. Without these burdens, cost recovery could be five percentage points better, with corresponding reductions in deficits.

There are some ways of restructuring the western interprovincial services, while still providing long-distance service. Such restructuring may reduce the overall deficit slightly, but it is unlikely that any significant improvements can be made. One type of service that might be investigated is the replacement of the long-distance, overnight operation with a series of daytime intercity trains. Capacity (seats per car) would rise and costs should fall. However, past experiments have not been overly successful, and market penetration — of a small market — might only be achieved by twice-a-day operation.

The results do not include tourist-only trains such as the *Rocky Mountaineer* which VIA operated in 1988 and 1989. This type of service should operate on a break-even basis[23] due to a very high revenue base and elimination of the need to provide service throughout the year and to all stations. Inclusion of tourist trains might improve the average financial performance of this service group. However, any real improvement would be by way of cross subsidy rather than by a true reduction of the costs of operating interprovincial services.[24]

VIA's 1994 *Corporate Plan* projections for the western services are similar to those determined here — a 37 percent operating cost recovery. The present study's estimates show a higher passenger count than does VIA due to the inclusion of the Prince Rupert service. VIA's estimates, however, allow for a greater emphasis on tourist services.

## 4.2 EASTERN INTERPROVINCIAL

Eastern interprovincial services (Montreal to Halifax via Saint John and via Campbellton) are similar in character to those in the west, but route and average trip lengths are correspondingly shorter than in the west. There are, however, a number of differences in the nature of the market resulting in lower ticket price yields in the east and the lack of growth potential.

Based on 1990 demand and services, fully allocated, steady-state costs are estimated to average $274 per passenger. Revenues are estimated at

$65, resulting in a 24 percent cost recovery rate and a $0.29 deficit per passenger-kilometre.

From a cost perspective, interprovincial services in the east are similar to the West. The shorter route distance and lower load factors in the east, however, contribute to higher costs per unit of transportation. The east doesn't appear to suffer as greatly from the three-days-a-week service inefficiencies. For one thing, there is six-days-a-week service between Montreal and Halifax (over two routes), and a significant part of the eastern routes are common (Montreal–Campbellton and Moncton–Halifax) giving the effect of nearly daily operation.

Opportunities for restructuring are also limited in the east. The possibility of a daytime service between Montreal and Moncton has been noted. A more obvious restructuring would involve collapsing the two Halifax trains into a single route. Net savings, however, are not likely to result in a significant improvement to cost recovery ratios, especially since any means of consolidation would come at the cost of some form of reduced or eliminated service on some portions of the affected routes.

The east also illustrates another passenger rail issue which is just starting to arise but may become more common. CN had received approval from the National Transportation Agency for the abandonment of its line between Chandler and Gaspé. Under present legislation, if passenger services are to continue to Gaspé, VIA must bear the full costs of line operation rather than paying a linehaul charge based on CN's national average long-run variable unit cost of its roadway. This would result in an increase in the effective cost of linehaul for the abandoned section of track from the range of $1,500 per track kilometre to the range of $5,000 to $5,500, and perhaps more if major track renewal is required. This increase does not affect eastern services as a whole, to any great extent, but it does make a significant difference to the incremental cost recovery for service to the Gaspé. Also, such changes may not signal an increase in the true cost of providing rail passenger service, but a change in attribution of costs. On some lines, passenger trains are the dominant traffic and are clearly one of the reasons that the line has been kept open.

VIA's projections for the eastern services of 1994 show a somewhat lower total operating cost recovery than is projected here. The present study estimates assume new equipment while VIA may actually be operating some older equipment in 1994; the difference is the study's focus on a longer term and the prospects for full viability. VIA also assumes a slightly higher rate of growth in passenger demand and fares.

## 4.3 LOW-DENSITY, SHORT-DISTANCE REGIONAL SERVICES

Until 1990, there were a number of low-density regional rail services. These were characterized by the use of short (one or two cars) self-propelled (SPV) trains. Route lengths ranged between 200 to 500 kilometres. Few amenities were offered on the typical regional service; many, in fact, offered no on-board services of any type. Passenger demand was generally low (less than 40 passenger-kilometres per train-kilometre) resulting in load factors in the range of 30 to 40 percent.[25]

Regional services (except for Victoria–Courtenay which was the subject of a constitutional court action) have now been eliminated. Nevertheless, submissions to the Royal Commission have advocated their reinstatement, and it is instructive to examine what their costs and performance might have been or might be. To this end, the somewhat integrated network of Maritime regional trains has been hypothetically resurrected (on paper). This included daily service between Halifax and Yarmouth, Sydney and Saint John; daily service between Moncton and Campbellton; and three-days-a-week service between Moncton and Edmundston. Based on typical 1988 demand patterns and service attributes, the fully allocated, steady-state costs of a regional rail service network are estimated to be $92 per passenger. Revenues are in the range of $19 per passenger. As a result, regional services average a 20 percent cost recovery rate.

Within a typical regional service network,[26] there is considerable variation in individual financial experience, driven mainly by differences in passenger demand and only partially by costs. It should be noted, however, that trimming the "poorest" services from a network may not improve the financial performance as much as might be expected since there are many common cost elements. This would be much less so if total networks closed down.

The low cost recovery rates experienced in this type of regional service are primarily a function of the low average passenger demand rather than any extraordinary cost issues. Crew, other linehaul and a number of other costs are governed by train-kilometres rather than train size. Thus, the average level of these cost components per passenger is much higher than that experienced in most other segments of the rail passenger system. A preponderance of short trips also affects the financial performance since a greater share of revenue is devoted to ticketing, passenger handling and marketing. This is not to say that low-density regional services are provided in a costly manner. If anything, the use of self-propelled vehicles means that this type of regional network could be operated in a very efficient manner, given the size of the market. However, no matter how efficiently operated, such rail services will rarely approach the cost effectiveness of a bus.

Short of a complete departure from standard North American railway practice and attempting to operate as a bus company on rails, no restructuring options have been identified that would result in any improvement that would lead to near cost recovery for short-distance, low-density regional service. There are possible options which would increase cost recovery rates by a few percentage points but nothing major. The main opportunity for improvement appears to be in increases in ridership/revenues, and such improvement would be restricted to an improved cost recovery percentage. Unless one projects unrealistic orders of magnitude of increased demand, a trend of demand increases for regional services would lead to higher absolute subsidies.

## 4.4 CORRIDOR SERVICES (MONTREAL–OTTAWA–TORONTO)

Corridor services (Montreal–Ottawa–Toronto) are characterized by three to six departures each way per day, moderate train sizes (four to eight cars) and a mix of origin-destination trips as well as "local" service. Load factors tend to be above 60 percent with 200 or more passenger kilometres per train-kilometre. Equipment utilization is reasonable. Services are provided using all-coach (not sleepers), locomotive-hauled cars. Given current technology and infrastructure conditions, speeds up to 145 kilometres per hour are achieved. At present, separate services are offered between Toronto and Montreal, Toronto and Ottawa, and between Montreal and Ottawa.

As described in more detail in subsection 3.1, the cost per passenger for corridor services is estimated at $73 based on 1990 corridor service patterns.[27] Including an allowance for increases in ridership and ticket yields, and full cost of capital charges, the deficit per passenger is estimated to be $35, resulting in a 52 percent total cost recovery rate.

One aspect of corridor services which may be a drain on their financial performance is a high incidence of peaking in passenger demand.[28] While this may not have a significant impact on pure train operation costs, it results in additional fleet requirements and adds to the total maintenance requirements. With the equipment available, the incremental costs of handling additional passengers in the corridor at off-peak times may be very low compared to the average noted above.

Compared to the 1990 situation, these projections reflect a significant potential for improvement. Could there be even greater improvement? The three segments of the corridor are relatively similar, but the financial performance of the Montreal–Ottawa segment is poorer than the other two segments. This is due to the shorter trip length (which results in higher customer service costs per passenger) and a lower level of demand[29] (which results in shorter trains with higher costs per passenger). While yields are slightly higher on this segment, the market is such that the additional costs cannot be fully reflected in the ticket price.

Since it is a "small" service, dropping the Montreal–Ottawa service would allow the balance of the corridor services to be operated with an overall deficit some $10 to $13 million lower, and result in a two or three percentage point increase in the level of cost recovery.[30] For the balance of the corridor, there appears to be little difference in the financial performance of the Montreal–Toronto and Ottawa–Toronto services (in spite of the relatively slow transit from Brockville to Ottawa). Deficits for Montreal–Toronto are higher, reflecting the greater level of activity (more trains per day and an extra 90-kilometre trip distance).

Within the corridor, there appear to be few opportunities for restructuring services. Longer, less frequent trains might be offered. However, the market demands frequency and choice of departure time. As was aptly demonstrated with the service reductions at the beginning of 1990, the reduction in frequency would reduce ridership. Savings would be strictly train-related, and the train-related component is not a large proportion of total costs.

Another possibility would be the combination of the three routes into a single, spinal route through Ottawa. Given the present services, combination of the three routes could offer much greater frequency with the possibility of further augmented revenues and a reduction in the extent of the network with potential savings. Unfortunately, with the present circuitous track routing, this would result in unacceptable increases in trip times for the Montreal–Toronto passengers. A route through Ottawa that would add only 37 kilometres or 7 percent to the Montreal–Toronto distance has been defined (and much of the right-of-way is already owned by VIA) but the investment in track necessary to achieve less than present transit time for Toronto–Montreal passengers would represent a very long-term commitment to the continuance of Toronto–Ottawa–Montreal rail service. It would seem reasonable that such investment should not be considered in isolation but as one of a series of quantum improvements in the corridor short of, or culminating with, electrified high-speed rail.

VIA's financial projections for 1994 for its Montreal–Ottawa–Toronto services are, in aggregate if not in detail, virtually the same as presented by this study — a 60 percent level of total operating cost recovery with just over two million passengers. The effect of VIA's higher estimate for ticket price ($40 as opposed to $38) has an equivalent to the impact of the difference in assumptions with respect to productivity in the steady state.

## 4.5 SOUTHWESTERN ONTARIO

Rail passenger service in southwestern Ontario (SWO) is characterized by short-distance coach service. Passenger trips tend to be short (averaging 183 kilometres). This results in an apparently low load factor (in the range of 45–50 percent).[31] While there is potential to increase ridership without increasing train sizes, a significant proportion of the empty seat-kilometres appears to be generated by the incidence of short trips into and out of Toronto — trips which are much shorter than the route distance.[32] In 1988, there was a mix of locomotive-hauled trains and self-propelled vehicles (SPVs). At the present time, locomotive-hauled trains are used exclusively. Most of the trains are 40-year old steam-heated equipment rather than the LRCs which are used in the corridor.

Based on 1990 passenger demand and services, fully allocated, steady-state costs are estimated to be $63 per passenger — significantly greater than the estimated revenues of $23 per passenger. The low cost recovery rate (36 percent) is indicative of the short-distance trips and the importance of the costs of stations, passenger handling and marketing.[33] These costs are somewhat higher per passenger than for Montreal–Toronto. The low cost recovery rate also reflects the use of locomotive-hauled equipment on some short train runs. In the SWO situation, the use of self-propelled equipment might be more advantageous, provided there is sufficient demand to justify a separate equipment pool.

Another aspect worth noting in southwestern Ontario is an apparent low equipment utilization rate. This stems both from maintaining a high peak-load capacity for Friday/Sunday service and from the fact that, given the schedules and apparent passenger demand, there are many train runs which require one full trainset to generate a relatively short round trip. The equipment itself is capable of providing significantly higher utilization. This implies that there would be capacity to increase off-peak carryings at less than the average incremental equipment-related costs, if the demand were there.

This study's estimates of total operating cost recovery (44 percent for southwestern Ontario) is somewhat higher than VIA's 1994 projection (40 percent). The major difference here is that VIA expects to be operating the existing equipment in this market until the end of 1994; while this study considers the longer term.

### 4.6 REMOTE SERVICES

The government has designated certain mandatory or remote services for protection. In some cases, there are communities served by rail where road alternatives do not exist. The designated mandatory services are characterized by low passenger volumes and very high subsidies per passenger. As a group, less than 10 percent of their costs are recovered through fares. The costs of the remote services are not considered in any detail in this paper. The relevant questions in these cases are whether passenger rail should be maintained as a social service, and whether there are cheaper ways of doing this than the present VIA operations.

The issue of remote services is considered in greater detail in Section 8.

## 5. International Rail, Particularly Amtrak, Comparability with VIA

Beyond the general, but important, point that they are usually government-owned and operated, and heavily subsidized, examination of foreign railway passenger systems, other than Amtrak, gives little guidance in resolving Canadian issues.

With few exceptions, worldwide railway passenger services are not commercial enterprises financed through passenger revenues. For the most part, passenger services are operated by government owned and supported railways. Table 6 summarizes three key indicators for VIA and for the national railway passenger operations of the United States and a number of member countries, of the Organisation for Economic Co-operation and Development (OECD), based on operating results for the year 1986.

*Table 6*

COMPARISON OF INTERNATIONAL RAIL PASSENGER SYSTEMS, 1986

| | **Railway market share[a] (%)** | **Operating cost recovery (%)** | **Average trip length (km)** |
|---|---|---|---|
| Japan | 38.1 | 59 | 28 |
| Switzerland | 12.6 | 76 | 41 |
| France | 9.5 | 61 | 78 |
| Austria | 9.4 | 61 | 46 |
| Spain | 9.4 | 40 | 81 |
| Italy | 7.9 | 23 | 102 |
| Belgium | 7.6 | 44 | 44 |
| Denmark | 7.5 | 65 | 31 |
| United Kingdom | 7.0 | 74 | 45 |
| (West) Germany | 6.8 | 59 | 41 |
| Sweden | 6.5 | 84 | 84 |
| Netherlands | 5.6 | 54 | 42 |
| Finland | 5.1 | 69 | 77 |
| Norway | 4.8 | 63 | 63 |
| **Canada[b]** | **1.9** | **30** | **360** |
| **United States[b]** | **0.7** | **56** | **397** |

**Source: T.H. Oum and C. Yu, *An International Comparison of the Economic Efficiency of Passenger Railway Systems*, a report prepared for the Royal Commission on National Passenger Transportation, RR-08, October 1991.**

**a Percentage of passenger-kilometres (metro systems excluded).**

**b Intercity only.**

In terms of operating cost recovery, VIA is near the bottom of the scale, but it is worth noting that few railways recover more than two thirds of operating costs. Also, with a variety of accounting practices[34] and the inclusion of some freight activity, the data presented in Table 6 are not strictly comparable. The average trip length illustrates an important difference between VIA and the OECD railways. Average passenger journeys are much longer in Canada. While some difference is due to geography, long-distance commuter and frequent regional services are a major part of most OECD systems. This is illustrated by the market share: VIA had less than 2 percent of the market, less than half of that of the lowest market share OECD railway system.

Most comparable to the Canadian railway passenger situation is that of the United States. The U.S. rail passenger system, Amtrak, was formed in 1971. Improvements in performance over recent years are examined below for Amtrak as a whole and by three service type categories. These are contrasted with the comparable VIA history. Service-specific data for Amtrak operations are presented and contrasted with data for VIA operations with similar superficial characteristics, and some explanation for performance differences is developed.

## 5.1 RECENT AMTRAK PERFORMANCE

Table 7 summarizes Amtrak performance at the system level from 1983 to 1989. The data for the table were primarily taken from Amtrak accounts and therefore do not include much of the cost associated with capital investment — depreciation, interest or cost of capital. Monies for capital investment allocated from Congress are not reflected in Amtrak's accounts.

Much of Amtrak's improvement took place in the mid to late 1980s. The key points of note for this period are:

- Amtrak has averaged 2 percent annual growth in ridership. On top of this, the average trip length has increased by more than 20 percent.
- There has been a steady improvement in financial performance as evidenced by a 50 percent increase in the revenue/total cost[35] ratio (from 0.45 to 0.66).
- Total operating expenses per passenger-kilometre fell by 5 percent, before taking inflation into account.[36] Adjusting for inflation, expense per passenger-kilometre dropped by 22 percent. While this represents a measure of cost control, it also reflects growing ridership and a sharing of costs over more passengers.
- There has been a significantly high, sustained program of investment by the U.S. government in Amtrak's equipment and infrastructure.

*Table 7*

## AMTRAK HISTORICAL DATA (CURRENT US$ UNLESS SPECIFIED)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|
| **Resources** | | | | | | | |
| Cars (operating fleet) | 1,480 | 1,379 | 1,523 | 1,661 | 1,705 | 1,710 | 1,742 |
| Locomotives (operating fleet) | 273 | 284 | 291 | 291 | 289 | 298 | 312 |
| Miles of roadway | 23,159 | 23,356 | 23,394 | 23,499 | 23,499 | 23,499 | 23,499 |
| Capital expenditures ($ million) | 215 | 351 | 293 | 175 | 138 | 184 | n.a. |
| Employees | 21,740 | 22,891 | 23,418 | 24,832 | 24,832 | 24,832 | 24,832 |
| **Traffic/Operating data** | | | | | | | |
| Passengers (million) | 18.9 | 19.5 | 20.8 | 20.3 | 20.4 | 21.5 | 21.4 |
| Passenger-miles (million) | 4,228 | 4,427 | 4,825 | 5,013 | 5,221 | 5,678 | 5,859 |
| Train-miles (million) | 28.8 | 29.1 | 30.0 | 28.6 | 30.0 | 30.0 | 31.0 |
| Car-miles (million) | 223.5 | 234.6 | 250.6 | 249.7 | 266.1 | 277.8 | n.a. |
| **Financial ($ million)** | | | | | | | |
| Operating revenues | 664 | 759 | 826 | 861 | 974 | 1,107 | 1,270 |
| Operating expenses | 1,469 | 1,522 | 1,600 | 1,564 | 1,672 | 1,757 | 1,935 |
| Net operating income | (805) | (763) | (774) | (702) | (699) | (650) | (665) |
| **Ratios/Indicators** | | | | | | | |
| Passenger-miles/ employee (thousand) | 194 | 193 | 206 | 201 | 210 | 228 | 235 |
| Passenger-miles/ train-miles | 146.8 | 152.1 | 160.8 | 175.3 | 174.0 | 189.3 | 189.0 |
| Average trip length (miles) | 224 | 227 | 232 | 247 | 256 | 264 | 274 |
| Operating revenues/ passenger-miles[a] | 0.192 | 0.201 | 0.195 | 0.191 | 0.201 | 0.204 | 0.217 |
| Operating expenses/ passenger-miles[a] | 0.424 | 0.404 | 0.378 | 0.347 | 0.345 | 0.323 | 0.330 |
| Revenue/Total cost ratio | 0.45 | 0.50 | 0.52 | 0.55 | 0.58 | 0.63 | 0.66 |
| Revenue/Total cost ratio (Amtrak)[b] | 0.54 | 0.56 | 0.58 | 0.62 | 0.65 | 0.69 | 0.72 |
| Revenue/Short-term avoidable cost | 0.80 | 0.83 | 0.86 | 0.96 | 1.03 | 1.15 | 1.20 |
| Revenue/Long-term avoidable cost | 0.68 | 0.70 | 0.71 | 0.78 | 0.79 | 0.90 | 0.97 |

**Note:** **n.a. = not available.**

**a** **Converted to 1989 constant U.S. dollars.**

**b** **Amtrak excludes depreciation from costs but includes non-federal subsidies ($7.8 million in 1989) in revenue.**

- Fare increases in excess of inflation have played a role (on average) in the improvement in financial performance, but do not appear to be the driving factor. Total revenue per passenger-kilometre increased some 13 percent after taking inflation into account. What is not clear is how much of this increase is attributable to passenger revenues and how much is attributable to increases in other revenues. The language of the trade literature and Amtrak's annual reports suggests that the latter contribution is considerable.
- Two of the major factors driving the steady reduction in unit operating costs have been changes in the way labour is compensated and improvements in asset utilization. For example, the average trainload (passenger-kilometres/train-kilometres) rose from 147 to 189, while the traffic density (passenger-kilometres/route-kilometres) progressed from 183,000 to 249,000. At the same time, crews were switched from the traditional distance base to an hourly pay system.
- Labour productivity, as measured by passenger-kilometres per employee, also improved by 3.3 percent per annum, although when measured in terms of trains handled it was static, suggesting that the productivity improvements were driven by growth in traffic volume. The data suggests a strategy of exploiting the company's advantages, particularly its highest density services, and reducing the cost of losers (but not necessarily eliminating them).
- The improvement in financial performance was not achieved by significantly reducing the size of the network. For the U.S. passenger system, service reductions occurred with (not after) the creation of Amtrak.[37] To a great extent, Amtrak appears to have been created as a rationalized network.

## 5.2 AMTRAK PERFORMANCE BY SERVICE CATEGORY

Table 8 compares Amtrak performance by service category, using 1989 data obtained from Amtrak (presented on a route-by-route basis in Table 10) and 1981 data reported in a Congressional Budget Office study.[38]

Amtrak divides its routes into three categories.

*Northeast Corridor (NEC):* These are five short/medium-distance intercity services in the most densely travelled corridor in the United States. The NEC is owned by Amtrak; it is being upgraded (extension of electrification, new equipment) primarily with public funds as decided by Congress. NEC services are characterized by the fastest trip times, the largest number of departures, the best on-time performances, and the highest revenue per passenger-kilometre (about 50 percent higher than the system average). The level of service on the New York City–Washington route has more in common with 200 kilometres per hour high-speed rail service, in terms of service attributes if not the speed, than with other North American passenger rail services. The NEC carries more than half the system traffic (passengers), for short average distances (211 kilometres). The revenue/LTAC ratio is 1.41 (system: 0.97), and reaches 1.81 for the premium service metroliners.

*Table 8*

*AMTRAK PERFORMANCE BY SERVICE CATEGORY: 1981 AND 1989 (1989 US$)*

| | **Northeast corridor** | | **Other short-distance** | | **Long-distance** | |
|---|---|---|---|---|---|---|
| | **1981** | **1989** | **1981** | **1989** | **1981** | **1989** |
| Passengers ('000) | 10,792 | 11,113 | 5,048 | 4,726 | 4,707 | 5,456 |
| Passenger-km (millions) | 1,756 | 2,349 | 1,078 | 1,038 | 4,799 | 6,012 |
| Revenues ($'000) | 191,755 | 344,402 | 89,207 | 101,894 | 357,439 | 456,591 |
| Short-term avoidable cost ($'000) | 200,032 | 189,451 | 150,149 | 107,049 | 543,663 | 465,098 |
| Long-term avoidable cost ($'000) | 242,538 | 243,964 | 182,055 | 132,649 | 659,189 | 614,685 |
| Average trip length (km) | 163 | 211 | 214 | 220 | 1,020 | 1,102 |
| Revenue/passenger-km ($) | 0.109 | 0.147 | 0.083 | 0.098 | 0.074 | 0.076 |
| STAC/passenger-km ($) | 0.114 | 0.081 | 0.139 | 0.103 | 0.113 | 0.077 |
| LTAC/passenger-km ($) | 0.138 | 0.104 | 0.169 | 0.128 | 0.137 | 0.102 |
| Revenue/STAC ratio | 0.96 | 1.82 | 0.59 | 0.95 | 0.66 | 0.98 |
| Revenue/LTAC ratio | 0.79 | 1.41 | 0.49 | 0.77 | 0.54 | 0.74 |

*Short-Distance Services:* These are 15 short/medium-distance services; daily departures range from one to seven per day; average speeds are from 53 to 100 kilometres per hour; 11 of the 15 services have on-time performances of 70 percent or above. In terms of markets served, level of service and financial performance, the "better" short-distance services are comparable with VIA's southwestern Ontario, Toronto–Ottawa and Ottawa–Montreal services. Only a few of the services compare to VIA's former regional services. The short-distance services carry one fifth of Amtrak's riders, for an average trip of 219 kilometres; revenue per passenger-kilometre (9.8 cents) is close to the system average.

*Long-Distance Services:* These are trips exceeding 12 hours in duration and include both north-south and transcontinental routes. (They are analogous to Canada's western and eastern interprovincial trains.) In the majority of cases, service is daily. A number of the services, particularly between Chicago and the West Coast, are split into separate sections in Salt Lake City or some other centre to provide direct service to a number of destinations. Speeds are relatively slow (88.5 kilometres per hour or below), while on-time performance is less reliable than other Amtrak services. The long-distance services carry 26 percent of Amtrak's riders for an average trip of 1102 kilometres; revenue per passenger-kilometre is 21 percent lower than the system average. The financial ratios are similar to those of the short-distance services (LTAC ratio of 0.74).

Table 8 indicates that the improvements in Amtrak performance were broadly based. Although the degree of financial improvement, as measured by the two revenue/cost ratios, was the greatest for the NEC, the LTAC ratio improved by 61 percent for the short-distance services and by 47 percent for long-distance services.

The data further suggest that the reasons for the financial improvements varied. Significant reductions in costs per passenger-kilometre occurred across the board, ranging from 26 percent (short-distance) to 32 percent (long-distance) for short-term avoidable, and averaging 24 to 25 percent for all groups for long-term avoidable. However, on the revenue side, real yields remained constant for long-distance services, improved moderately (19 percent) for short-distance services, and most significantly they improved by 34 percent for northeast corridor services.

Long-distance fares were presumably constrained by air competition in the aftermath of deregulation. When measured in terms of average fare, the NEC increase was even more impressive, due to the 30 percent increase in average trip length.

## 5.3 COMPARISON WITH VIA

There are differences in costing treatment and in the determination of equitable payments by the passenger operator to the freight railways that affect the apparent relative costs and cost recovery.

Initially, payments by Amtrak for services provided by the freight railways were based on strictly avoidable[39] or short-run variable cost. Canadian railways' remuneration is mandated according to a long-run variable[40] definition. This was not intended to provide full cost recovery; the initial contracts with Amtrak provided that the "railroad is willing to waive, during an interim period, certain elements of compensation. . . ." However, for most railroads dealing with Amtrak that initial period is over. They have negotiated contract amendments that provide, in aggregate, improved remuneration.

Increasingly, both Amtrak and VIA negotiate contracts with the freight railways, that may depart from the cost definitions above, for track occupancy and other services. Nonetheless, the base line for negotiation seems to remain the cost computed pursuant to the operational legislation for each system. In essence CP Rail and CN Rail receive payments compensating them for a broader definition of the track ownership and maintenance and other costs of services provided to VIA than applies to the U.S. railroads for services provided to Amtrak. While the differences between VIA and Amtrak in this area are substantially more favourable for Amtrak, it is of little consequence in terms of services viability. VIA's train service agreements with CN and CP now account for, at most, 10 percent of VIA's total expenses, and any savings from more stringent terms would be a small fraction of that small percentage.

The ownership, by Amtrak, of assets from which it can earn income effectively defrays some of the deficit from intercity passenger rail operations. It also means Amtrak's cost recovery percentage appears to be higher, relative to that of VIA, than it otherwise would be. For example, if Amtrak's incremental long-run costs of earning the $360 million in other revenues in 1989 were one third of that level ($120 million), the total cost recovery rate for passenger train operation would be 50 percent, not 66 percent. This should not be misinterpreted as stating that Amtrak somehow "hides" its true losses or has "hidden" subsidies; Amtrak has simply found other, non-passenger, sources of revenue with which to share the cost of some of the assets and operations that are required for the passenger operations.

In the comparisons that follow, no attempt has been made to adjust the financial data or for differences in accounting practices or payment principles as discussed above. This would require considerable analytical effort and could be imperfect at best. More importantly, it would add little to an understanding of the principal differences between Amtrak and VIA from the perspective of the Royal Commission. The key observation is that Amtrak has been able to improve its financial position progressively and substantially. VIA's results, on the other hand are clouded by externally imposed (by government decision) routes and services changes and unusual expenses; however, it is apparent that cost recovery improvement paralleling that of Amtrak has not occurred.

A quick comparison for 1989 reveals sharp differences as presented in Table 9.

*Table 9*
*Comparison of 1989 Performance by Amtrak, VIA*

| | Amtrak | VIA |
|---|---|---|
| Total passengers carried (millions) | 21.40 | 6.46 |
| Total cost recovery ratio (depreciation excluded) | 72% | 34% |
| Operating deficit per passenger (US$ and CAN$) | 31.00 | 82.00 |
| Operating deficit per passenger-km (US$ and CAN$) | 0.07 | 0.22 |
| "Service-related" revenue per passenger | 42.40 | 36.90 |
| "All other" revenue per passenger (US$ and CAN$) | 17.00 | 0.90 |

VIA's operating deficit per passenger is more than three times that of Amtrak. VIA's revenues cover about a third of operating costs; Amtrak's cover well over two thirds.

Although VIA's average fares lag behind those of Amtrak for comparable trips by approximately the exchange rate (if that is an appropriate measure), the differences cannot be substantially attributed to revenue yield or average fare. Amtrak is attracting about 15 percent more "service," revenue per passenger than VIA. This is reasonable since Amtrak's average passenger trip is about 16 percent longer than VIA's, and on a passenger-kilometre basis Amtrak's US$ yields averaged slightly less than VIA's (in CAN$). It is of interest to note that Amtrak's yields for the Northeast Corridor are noticeably higher than VIA's M–O–T corridor yields while their regional and long-distance yields are noticeably lower than VIA's for corresponding business segments.

Amtrak receives state subsidies, known as section 403(b) payments,[41] for some of its operations. These are treated as earned revenue. While such payments vary greatly by route, the total in 1989 was only $7.8 million, less than $0.37 per passenger on a system basis. With the exception of a small payment by the province of Ontario, VIA receives no non-federal monies. Thus, non-federal subsidies are not significant in a comparison between the United States and Canada.

The non-passenger, non-subsidy revenue appears to make a significant difference. In 1989 Amtrak earned approximately $360 million[42] ($17.00 per passenger) from contract commuter operations, contract shop and maintenance operations, right-of-way leasing, real estate development, electrical co-generation and mail and express services. Such earnings account for nearly 30 percent of Amtrak's total revenues. VIA earned almost no such revenues. In the case of mail and express, VIA has concluded that there is little opportunity in this area. In the case of commuter operations and station development, VIA has not been in a good position to exploit any opportunities since many of the assets belong to CN and CP.[43]

Such additional funds could not, however, drastically reduce the gap between Amtrak and VIA. Assuming the same level of gross revenue per passenger and that only one third of the revenue represents incremental long-run avoidable costs, then VIA's deficit per passenger might be reduced by some 15 percent. But it would still be about two and a half times higher than Amtrak's, after correction for the difference in passenger trip lengths.

It is clear that Amtrak is outperforming VIA, and it is on the cost side that the major differences between VIA and Amtrak must be explained. There are a number of areas noted below where Amtrak has an advantage over VIA.

- Amtrak has been operating for many years with new or rebuilt equipment. With the exception of the LRC, which was an unfortunate acquisition, VIA is just starting to obtain new locomotives and rebuild cars.
- Amtrak, to a large extent, has rationalized its crew size and a number of other labour practices. VIA is just starting.
- Amtrak's average train load is 20 percent greater than VIA's. This results in a lower average cost per passenger in many functional areas, such as crew.
- Amtrak's activities constitute a more balanced network and are more concentrated than VIA's. Amtrak has a more rational system than has VIA in the way that its routes and schedules link to each other and to maintenance

facilities, resulting in more intensive use of assets such as cars, locomotives, maintenance facilities and stations. This again contributes to a lower cost per passenger. For example, Amtrak gets 50 percent more use out of a passenger car than does VIA. Much of VIA's lower utilization is driven solely by the nature of VIA's network and service frequencies, not by the age of its fleet.

- Amtrak may pay the freight railways less for the use of track than VIA. As noted below, the Amtrak legislation specifies incremental costs as the basis for track pricing. For VIA it is long-run variable, including the long-run variable portion of the cost of capital.

From the available relative data for comparable services, it is estimated that VIA might be operating in the 60 percent range[44] for overall operating cost recovery if it had:

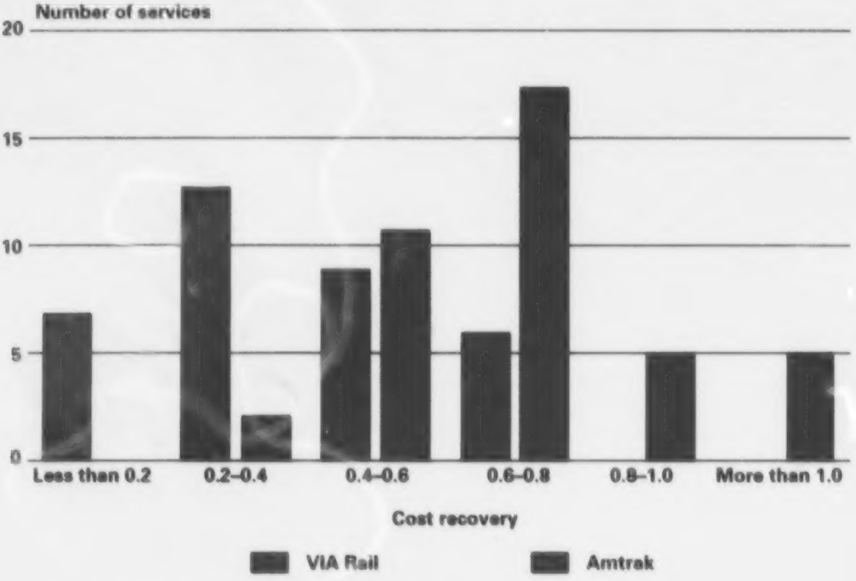
- Amtrak's crew practices and costs;
- up-to-date equipment;
- no remote or very low-density regional services;
- greater passenger loads per train; and
- Amtrak's management practices and effectiveness.

It has been popular to argue that, were VIA managed as efficiently as Amtrak, it would recover a substantially greater portion of its cost. The above differences are relevant to this topic. Amtrak's relatively easy access to costless capital from Congress, and the fact that the cost of this capital is not reflected in the company's accounts, are probably more important.

**Comparison of Individual Services**

Figure 2 compares the general level of cost recovery for Amtrak services and for VIA services in 1989. The ratio used for VIA services is revenue to avoidable cost (as calculated by VIA); for Amtrak the ratio of revenue to LTAC has been used. While there may be a slight bias against VIA, the two measures are comparable.[45] Nonetheless, it is clear that the frequency distribution of VIA cost ratios is well to the left of that of the Amtrak services. In 1989, most NEC services covered their long-term avoidable costs; none of the VIA services did.

*Figure 2*
*AMTRAK AND VIA COST RECOVERY BY SERVICE*
*COST RECOVERY IS SCATTERED*



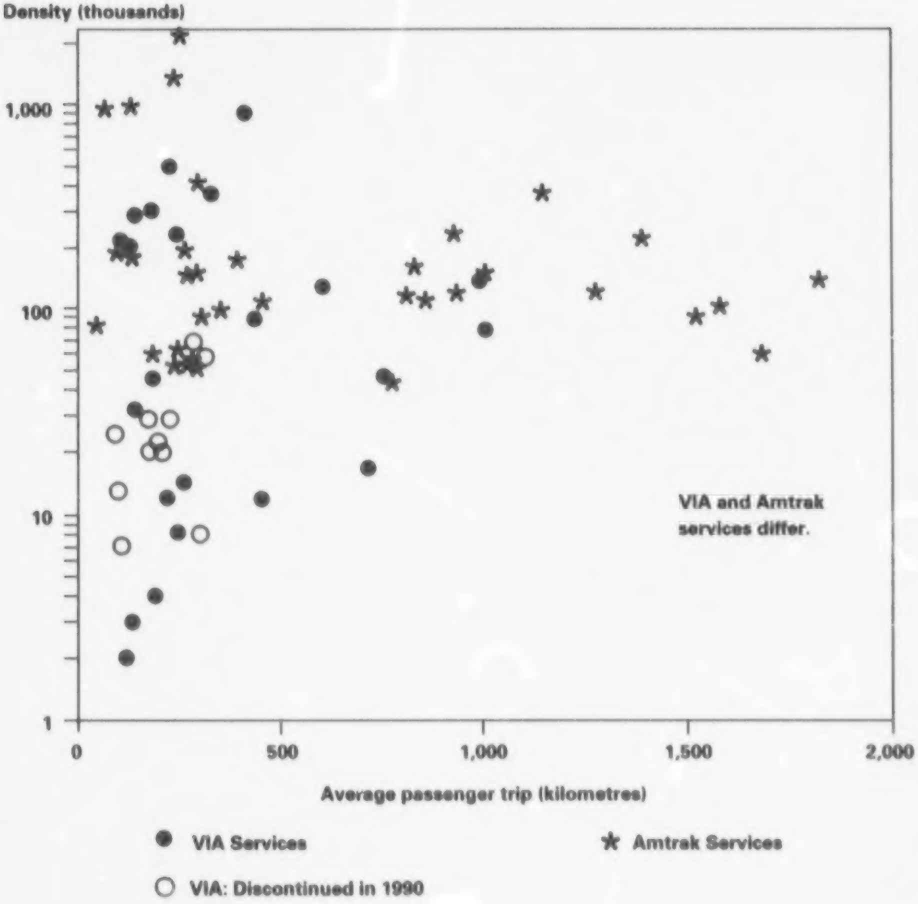
**Note: Data are for 1989 (prior to 1990 cuts)**

Amtrak route-specific financial and operational data are presented in Table 10. Figure 3, contrived to illustrate similarities and differences among services, compares traffic density for Amtrak and VIA services, based on 1989 data.

Traffic density is defined as passenger-kilometres per route-kilometre. The other axis indicates the average trip length for a rider on the service (passenger-kilometres per passenger). Caution should be exercised in drawing detailed service-specific conclusions from this figure, particularly on some of the (mostly longer distance) Amtrak services that are not named on the illustration. There are difficulties with definition. Is a train that originates in Chicago and splits in Salt Lake City continuing in sections to Oakland, Seattle and Los Angeles one service? or three? or four?

*Figure 3*

### AMTRAK AND VIA SERVICES — DENSITY AND LENGTH



Sources: Data provided by carriers and Royal Commission staff calculations.

Note: Density = pass-km per route-km.

Table 10

1989 AMTRAK RESULTS BY SERVICE

| Route | Route-km | Daily trains | Best trip time | Avg. speed (km/h) | On-time perfor-mance | Pass-trips ('000) | Pass-km ('000) | Avg. pass-trip (km) | Route density pkm/rkm ('000) |
|---|---|---|---|---|---|---|---|---|---|
| New York–Washington Metroliner | 360 | 16 | 2:37 | 138 | 93% | 2,063 | 490,606 | 238 | 1,361 |
| NEC Conventional | 764 | 19 | 3:17 | 110 | 84% | 6,622 | 1,665,702 | 252 | 2,179 |
| Washington–Atlantic City | 325 | 4 | 3:11 | 102 | 80% | 106 | 19,795 | 187 | 61 |
| New York–Philadelphia | 146 | 6 | 1:14 | 119 | 86% | 2,005 | 139,194 | 69 | 950 |
| New York–Phil.–Harrisburg | 167 | 6 * | 1:53 | 89 | 93% | 317 | 33,849 | 107 | 202 |
| **N.E. corridor services subtotal** | | | | | | **11,113** | **2,349,146** | **211** | |
| Chicago–St. Louis | 457 | 17/wk * | 5:55 | 77 | 32% | 243 | 69,337 | 285 | 152 |
| Chicago–Milwaukee | 137 | 5 * | 1:26 | 95 | 92% | 197 | 26,205 | 133 | 192 |
| Chicago–Detroit–Toledo | 542 | 2 | 7:20 | 74 | 82% | 296 | 81,103 | 274 | 150 |
| Chicago–Carbondale | 497 | 1 * | 5:26 | 92 | 86% | 91 | 28,881 | 317 | 58 |
| Chicago–Quincy | 423 | 1 | 4:15 | 100 | 78% | 79 | 22,946 | 290 | 54 |
| Chicago–Port Huron–(Toronto) | 505 | 1 | 6:10 | 82 | 64% | 99 | 28,154 | 284 | 56 |
| Chicago–Valparaiso | 71 | 5/wk * | 1:20 | 53 | 86% | 139 | 5,850 | 42 | 83 |
| Chicago–Indianapolis | 314 | 1 * | 4:10 | 75 | 57% | 63 | 16,872 | 268 | 54 |
| Chicago–Grand Rapids | 291 | 1 | 3:52 | 75 | 76% | 66 | 15,759 | 239 | 54 |
| Los Angeles–San Diego | 204 | 8 | 2:45 | 74 | 76% | 1,694 | 220,358 | 130 | 1,078 |
| Portland–Seattle | 299 | 1 * | 4:00 | 75 | 79% | 79 | 19,803 | 251 | 66 |
| Oakland–Bakersfield | 501 | 2 | 6:05 | 82 | 77% | 363 | 95,357 | 263 | 191 |
| (New York)–Albany–Montreal | 377 | 1 | 7:10 | 53 | 32% | 90 | 41,442 | 460 | 110 |
| New York–Niagara Falls | 742 | varies | 7:47 | 95 | 78% | 1,053 | 312,796 | 297 | 422 |
| (New York)–Phil.–Pittsburgh | 566 | 1 * | 7:14 | 78 | 73% | 174 | 52,799 | 303 | 93 |
| **Short-distance services subtotal** | | | | | | **4,726** | **1,037,664** | **220** | |

*Table 10 (cont'd)*

## 1989 AMTRAK RESULTS BY SERVICE

| Route | Route-km | Daily trains | Best trip time | Avg. speed (km/h) | On-time perfor-mance | Pass-trips ('000) | Pass-km ('000) | Avg. pass-trip (km) | Route density pkm/rkm ('000) |
|---|---|---|---|---|---|---|---|---|---|
| Washington–Montreal | 1,160 | 1 | 18:24 | 63 | 89% | 29 | 20,075 | 692 | 17 |
| New York–Columbia–Florida | 2,264 | 1 | 26:23 | 86 | 51% | 429 | 524,451 | 1,222 | 232 |
| New York–Charleston–Florida | 2,332 | 1 | 26:28 | 88 | 51% | 454 | 541,491 | 1,193 | 232 |
| New York–Jacksonville | 1,592 | 1 | 16:45 | 95 | 71% | 193 | 151,142 | 783 | 95 |
| Auto Train (Washington–Florida) | 1,399 | 1 | 17:30 | 80 | 77% | 230 | 316,847 | 1,378 | 227 |
| Chicago–Philadelphia–New York | 1,466 | 1 | 19:02 | 77 | 63% | 194 | 180,895 | 932 | 123 |
| Chicago–Washington–New York | 1,849 | 3/wk | 26:40 | 69 | 72% | 105 | 80,981 | 771 | 44 |
| Chicago–Washington | 1,233 | 1 | 17:22 | 71 | 71% | 164 | 138,887 | 847 | 113 |
| Chicago–Albany–New York/Boston | 1,545 | 1 | 18:30 | 84 | 55% | 380 | 314,466 | 828 | 204 |
| Chicago–Seattle/Portland | 3,568 | 1 | 45:40 | 78 | 43% | 413 | 522,898 | 1,266 | 147 |
| Chicago–Salt Lake City–Oakland | 3,898 | 1 | 51:10 | 76 | 20% | 408 | 540,955 | 1,326 | 139 |
| (Chicago)–SLC–Seattle | 4,328 | 1 | 56:35 | 76 | 28% | 151 | 210,071 | 1,391 | 49 |
| (Chicago)–SLC–Los Angeles | 3,854 | 1 | 49:07 | 78 | 59% | 161 | 305,213 | 1,896 | 79 |
| Chicago–Centralia–New Orleans | 1,487 | 1 | 18:05 | 82 | 27% | 213 | 173,809 | 816 | 117 |
| Kansas City–Centralia–(New Orl.) | 552 | 1 | 7:10 | 77 | 46% | 160 | 55,252 | 345 | 100 |
| Chicago–Sante Fe–Los Angeles | 3,615 | 1 | 41:10 | 88 | 35% | 283 | 513,404 | 1,814 | 142 |
| Chicago–Texas–(Los Angeles) | 2,007 | 3/wk | 26:00 | 77 | 44% | 157 | 237,165 | 1,511 | 118 |
| New Orleans–Los Angeles | 3,272 | 3/wk | 41:00 | 80 | 70% | 115 | 194,750 | 1,693 | 60 |
| Los Angeles–Seattle | 2,237 | 1 | 32:55 | 68 | 64% | 568 | 524,699 | 924 | 235 |
| Boston–Newport News | 666 | 1 * | 12:25 | 54 | 84% | 302 | 117,890 | 390 | 177 |
| New York–New Orleans | 2,221 | 1 | 29:45 | 75 | 73% | 347 | 346,819 | 999 | 156 |
| **Long-distance services subtotal** | | | | | | **5,456** | **6,012,159** | **1,102** | |
| **Grand total** | | | | | | **21,295** | **9,398,969** | **581** | |

**Note: See Appendix D: Notes to Amtrak Route-Specific Data.**

Table 10 *(cont'd)*

### 1989 AMTRAK RESULTS BY SERVICE

| Route | Pass-revenue ($'000) | Non-federal payments ($'000) | Short-term avoid. costs ($'000) | Long-term avoid. costs ($'000) | Rev. to cost ratio (short) | Rev. to cost ratio (long) | Rev. per pass-km ($) | LTAC per pass-km ($) | See Appendix D notes to specific line entries |
|---|---|---|---|---|---|---|---|---|---|
| New York–Washington Metroliner | 109,572 | | 47,646 | 60,630 | 2.30 | 1.81 | 0.223 | 0.124 | |
| NEC Conventional | 217,302 | | 122,741 | 158,597 | 1.77 | 1.37 | 0.130 | 0.095 | |
| Washington–Atlantic City | 1,861 | | 4,514 | 5,613 | 0.41 | 0.33 | 0.094 | 0.284 | 15 |
| New York–Philadelphia | 12,881 | | 9,148 | 12,782 | 1.41 | 1.01 | 0.093 | 0.092 | |
| New York–Phil.–Harrisburg | 2,786 | 405 | 5,402 | 6,747 | 0.52 | 0.41 | 0.082 | 0.199 | |
| **N.E. corridor services subtotal** | **344,402** | **405** | **189,451** | **244,369** | **1.82** | **1.41** | **0.147** | **0.104** | |
| Chicago–St. Louis | 5,409 | 783 | 8,761 | 11,415 | 0.62 | 0.47 | 0.078 | 0.165 | |
| Chicago–Milwaukee | 2,259 | | 3,235 | 4,078 | 0.70 | 0.55 | 0.086 | 0.156 | 7 |
| Chicago–Detroit–Toledo | 5,565 | | 9,717 | 12,632 | 0.57 | 0.44 | 0.069 | 0.156 | |
| Chicago–Carbondale | 2,660 | 138 | 3,119 | 4,167 | 0.85 | 0.64 | 0.092 | 0.144 | |
| Chicago–Quincy | 2,082 | 651 | 2,835 | 3,590 | 0.73 | 0.58 | 0.091 | 0.156 | |
| Chicago–Port Huron–(Toronto) | 2,721 | 417 | 3,196 | 4,048 | 0.85 | 0.67 | 0.097 | 0.144 | |
| Chicago–Valparaiso | 336 | | 971 | 1,311 | 0.35 | 0.26 | 0.057 | 0.224 | |
| Chicago–Indianapolis | 1,396 | | 2,579 | 3,207 | 0.54 | 0.44 | 0.083 | 0.190 | |
| Chicago–Grand Rapids | 1,662 | 465 | 2,186 | 2,749 | 0.76 | 0.60 | 0.105 | 0.174 | |
| Los Angeles–San Diego | 22,686 | 940 | 21,542 | 27,160 | 1.05 | 0.84 | 0.103 | 0.123 | 1 |
| Portland–Seattle | 1,426 | | 2,357 | 2,912 | 0.61 | 0.49 | 0.072 | 0.147 | |
| Oakland–Bakersfield | 9,573 | 1,548 | 11,597 | 14,388 | 0.83 | 0.67 | 0.100 | 0.151 | |
| (New York)–Albany–Montreal | 3,840 | 227 | 4,162 | 5,240 | 0.92 | 0.73 | 0.093 | 0.126 | 6 |
| New York–Niagara Falls | 35,144 | | 26,649 | 35,769 | 1.32 | 0.98 | 0.112 | 0.114 | 14 |
| (New York)–Phil.–Pittsburgh | 5,135 | 310 | 4,143 | 5,462 | 1.24 | 0.94 | 0.097 | 0.103 | |
| **Short-distance services subtotal** | **101,894** | **5,479** | **107,049** | **138,128** | **0.95** | **0.74** | **0.098** | **0.133** | |

Table 10 *(cont'd)*

## 1989 AMTRAK RESULTS BY SERVICE

| Route | Pass-revenue ($'000) | Non-federal payments ($'000) | Short-term avoid. costs ($'000) | Long-term avoid. costs ($'000) | Rev. to cost ratio (short) | Rev. to cost ratio (long) | Rev. per pass-km ($) | LTAC per pass-km ($) | See Appendix D notes to specific line entries |
|---|---|---|---|---|---|---|---|---|---|
| Washington–Montreal | 1,780 | | 2,143 | 2,694 | 0.83 | 0.66 | 0.089 | 0.134 | 2 |
| New York–Columbia–Florida | 36,883 | | 35,068 | 47,541 | 1.05 | 0.78 | 0.070 | 0.091 | 8 |
| New York–Charleston–Florida | 37,170 | | 32,749 | 44,219 | 1.13 | 0.84 | 0.069 | 0.082 | 8 |
| New York–Jacksonville | 12,203 | | 10,804 | 14,323 | 1.13 | 0.85 | 0.081 | 0.095 | 9 |
| Auto Train (Washington–Florida) | 43,997 | | 29,823 | 38,499 | 1.48 | 1.14 | 0.139 | 0.122 | 10 |
| Chicago–Philadelphia–New York | 17,038 | | 17,484 | 23,982 | 0.97 | 0.71 | 0.094 | 0.133 | |
| Chicago–Washington–New York | 6,395 | | 9,830 | 12,746 | 0.65 | 0.50 | 0.079 | 0.157 | |
| Chicago–Washington | 12,866 | | 15,005 | 20,147 | 0.86 | 0.64 | 0.093 | 0.145 | |
| Chicago–Albany–New York/Boston | 26,979 | | 24,992 | 34,352 | 1.08 | 0.79 | 0.086 | 0.109 | 5 |
| Chicago–Seattle/Portland | 37,174 | | 43,999 | 57,952 | 0.84 | 0.64 | 0.071 | 0.111 | 12 |
| Chicago–Salt Lake City–Oakland | 43,245 | | 46,009 | 59,942 | 0.94 | 0.72 | 0.080 | 0.111 | 3 |
| (Chicago)–SLC–Seattle | 12,012 | | 16,648 | 21,890 | 0.72 | 0.55 | 0.057 | 0.104 | 3 |
| (Chicago)–SLC–Los Angeles | 16,433 | | 15,671 | 20,881 | 1.05 | 0.79 | 0.054 | 0.068 | 3 |
| Chicago–Centralia–New Orleans | 12,044 | | 15,570 | 21,404 | 0.77 | 0.56 | 0.069 | 0.123 | |
| Kansas City–Centralia–(New Orl.) | 4,044 | 1,940 | 6,998 | 8,924 | 0.58 | 0.45 | 0.073 | 0.162 | 4 |
| Chicago–Santa Fe–Los Angeles | 35,347 | | 35,901 | 48,881 | 0.98 | 0.72 | 0.069 | 0.095 | 13 |
| Chicago–Texas–(Los Angeles) | 13,450 | | 17,199 | 22,197 | 0.78 | 0.61 | 0.057 | 0.094 | |
| New Orleans–Los Angeles | 11,826 | | 16,590 | 21,416 | 0.71 | 0.55 | 0.061 | 0.110 | |
| Los Angeles–Seattle | 37,673 | | 36,936 | 47,092 | 1.02 | 0.80 | 0.072 | 0.090 | 11 |
| Boston–Newport News | 10,286 | | 6,626 | 8,257 | 1.55 | 1.25 | 0.087 | 0.070 | |
| New York–New Orleans | 27,746 | | 29,053 | 39,286 | 0.96 | 0.71 | 0.080 | 0.113 | |
| **Long-distance services subtotal** | **456,591** | **1,940** | **465,088** | **616,625** | **0.98** | **0.74** | **0.076** | **0.103** | |
| **Grand total** | **902,887** | **7,824** | **761,508** | **999,122** | **1.19** | **0.90** | **0.096** | **0.106** | |

However, it is clear that there are fundamental differences between the low-density regional and remote services provided by VIA and Amtrak's higher-density operations, differences that do something to explain VIA's poorer cost recovery. There are also VIA and Amtrak services that are sufficiently similar to make general comparison reasonable, and here the VIA cost recovery (see Figure 4) may not always fall below that for Amtrak. For example, the recovery of the Chicago–Milwaukee service might not appear superior to Toronto–Stratford–London if the cost of both are stated on equivalent bases. This would require much more detailed research, and overall, Amtrak's cost recovery is clearly superior to VIA's.

Viewing the comparative data:

- VIA runs (although several of the services shown in Figure 3 were cut in 1990) low-density routes with short average trips, with which no Amtrak services are even remotely comparable. These regional and remote services can benefit neither from economies of density, nor from good load factors.[46]
- VIA has at least one service, Montreal to Toronto, with characteristics that appear favourable relative to some of the more viable Amtrak operations. For example, in many respects this VIA service would seem to be the equal of, with possible advantages over, the Los Angeles to San Diego service which recovers 84 percent of long-run avoidable cost, and the New York to Niagara Falls service for which 98 percent is recovered. The question arises: Why, when so well placed relevant to high cost recovery Amtrak services, is this VIA service not closer to being financially viable?

  The relationship of this service to the NEC including the metroliner (electric) operation is also instructive (NEC conventional and metroliner services recover 137 percent and 181 percent of LTAC respectively). Of course, NEC densities are much higher than those of Montreal–Toronto, and there is electrified operation.

- There are four Amtrak moderate-density services with characteristics similar to VIA's Quebec City–Windsor services (other than M–O–T). These include:

| | **Operating Cost** |
|---|---|
| New York–Niagara Falls | 98% recovery |
| Philadelphia–Harrisburg | 41% recovery |
| Chicago–Milwaukee | 55% recovery |
| Oakland–Bakersfield | 67% recovery |

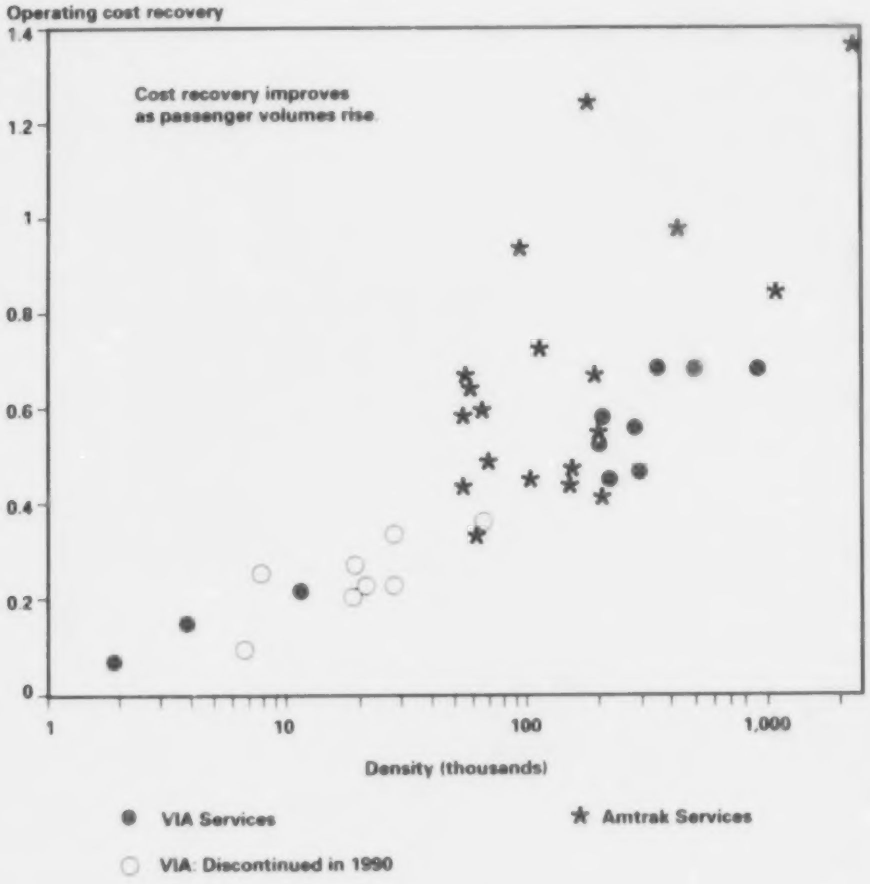
All are losing money and would show greater losses if evaluated on a fully allocated cost basis. However performance appears superior to similar VIA services. Toronto–London (53 percent avoidable recovery) is not dissimilar to the Chicago–Milwaukee or Philadelphia–Harrisburg Amtrak services, and all three share the large-to-small city, as well as the short-distance, low-density characteristics. Oakland–Bakersfield has superficial comparability to Montreal–Quebec City, although the capital contribution by the State of California clearly aids the Amtrak service. VIA's Toronto–Ottawa (69 percent avoidable cost recovery) is similar to Amtrak's New York–Niagara Falls services. Here again, Amtrak clearly benefits from state payments under section 403(b) and from the use of the turbo equipment.

Figure 4 illustrates operating cost recovery for selected Amtrak and VIA services. Excluded are services where the average passenger travels less than 100 kilometres, services where sleeping accommodation is provided and Amtrak's metroliner. At least some of Amtrak's apparently superior cost recovery is attributable to a more generous accounting treatment and not greater operating efficiency. More important, however, are the parallel relations of cost recovery to density, and the relatively poor performance of VIA's lowest density services, some of which were eliminated in 1990. It is also relevant to note that few services of either railway recover their operating cost.

Although cost recovery was not the government's only objective for VIA, it is apparent from Figure 4 that this objective would have been better served by eliminating more of the sparsely used VIA services, while improving service and increasing fares on the popular runs. This was the strategy adopted for Amtrak, especially at the outset. Of course Amtrak does not provide service to remote communities without road access.

*Figure 4*

AMTRAK AND VIA: 1989 OPERATING COST RECOVERY: INTERMEDIATE DISTANCE NON-SLEEPER SERVICES



Sources: Data provided by carriers and Royal Commission staff calculations.

Note: Density = pass-km per route-km.

At this juncture of the analysis, a definitive response to the question of the potential viability of the VIA regional services eliminated in 1990 is appropriate. These are among the services falling in the low-density/low-cost-recovery quadrant of Figure 4. A ten-fold demand increase would be necessary before there would be any prospect of operating cost recovery. This is not a realistic prospect.

## 6. POTENTIAL EFFECT OF DIFFERING AMTRAK AND VIA MANDATES

Differences in the nature of the United States and Canadian markets, different accounting treatments, different payment arrangements for access to the track infrastructure, greater renewal, at the government's expense, of rolling stock, and assets with value beyond the provision of intercity railway passenger services, only partially explain Amtrak's superior financial performance. Further, an important question remains only partially answered: *Why has the financial performance of Amtrak improved so impressively while that of VIA has been, at best, stagnant?*

Amtrak and VIA may serve similar roles, continuance of the non-commuter railway passenger services that would have been abandoned by commercial enterprises permitted to do so, but there are important differences in the degree and nature of the government's role versus that of corporate management.

Amtrak is a relatively independent quasi-public corporation with a "for profit" mandate and "owned" by its participating railroad common[47] shareholders.[48] It is managed by a board of directors that includes nominees of the Department of Transportation, a state governor and representatives of commuter agencies, the business community and organized labour. Congress has the principal policy-making role and audits Amtrak's performance. Funds are channelled to Amtrak by Congress through the Federal Railroad Administration but there is not believed to be Administration intervention on routing, service or pricing matters. From a current perspective, the substantial rationalization of Amtrak services in the early 1970s, according to a service plan developed by the Department of Transportation, was doubtless influenced by political considerations, but it was massive and left the corporation with a network that allowed efficient use of equipment and fixed plant assets.

VIA is managed by a board of directors appointed by the government, but effective decision making, with respect to most service parameters with an important public profile, is exercised directly by Cabinet and the Minister of

Transport, advised by Transport Canada. VIA's president is appointed directly by the government, not by the Board of Directors. Pricing, routing and service levels on one hand, and equipment and fixed facilities capital investment on the other, all tend to be effectively controlled by the Minister.[49] Even timetable adjustments require the Minister's approval; if approval is delayed, ticketing and reservations cease. The formal participation of VIA executive management in the political process that determines its service levels is minimal, and effective intervention is largely through the press.

Amtrak and VIA have quite different reporting relationships and consequently, very different results in terms of latitude for managerial discretion and public and legislator influence of, and participation in, the decision-making process.

## 6.1 VIA AND AMTRAK MANDATES

VIA Rail is, in a formal sense, accountable to the Minister of Transport (and effectively Treasury Board) for the provision of a specified package of services in exchange for specified (subsidy) payments, under the terms of a formal (annual) contract between them. There is no legislation, other than the *Appropriation Act* and the *Financial Administration Act* that specifies a relationship between VIA and either Parliament or the Minister. The contract is quite specific with respect to operational parameters such as equipment deployed, capacity offered and schedules. The terms of the contract are negotiated, and performance under the contract is monitored, by Transport Canada staff on behalf of the Minister. It is specified that any departure from the relatively detailed specifications in the annual contract must be approved by the Minister. VIA is accountable through the annual contract in force to the Minister, and the Minister is accountable for funds provided to VIA to the Treasury Board and Parliament. In practice, VIA is scrutinized and held accountable mainly through the annual budgeting and corporate plan approval process.

Amtrak was created by an Act of Congress, the *Rail Passenger Service Act*, and is dependent for its operating deficit and capital funding on appropriation bills passed by Congress, traditionally overriding the recommendation of the Administration. The annual authorization of funding may be accompanied by amendment to the *Rail Passenger Service Act*, quite an open process. In a practical sense, Amtrak answers to Congress as a whole regarding the financial performance of the corporation, and to individual Congressional representatives where its activities are of local interest. Amtrak is accountable to the Federal Railroad Administration only for safety matters. While justification of VIA's performance and continuance is concentrated on the Canadian Minister (as influenced by political colleagues), it is Amtrak that must build and maintain its own political constituency. The corporation itself balances local interests as necessary to maintain its funding, and has the opportunity to best accommodate its network and efficiency considerations.

Amtrak may not be perfectly free in its ability to make commercial decisions, just as CN is not perfectly free, but VIA's situation is much worse. Like Amtrak, VIA would only have a chance to make a profit with a network reduced to a handful of services. However, VIA's lack of a viable mandate and the commercial freedom necessary to improve its financial circumstances, as distinct from relative managerial competence,[50] must bear some responsibility for the magnitude of its poor performance relative to Amtrak.

As discussed, the absolute level of Amtrak's higher cost recovery is influenced by circumstances that include advantages of infrastructure ownership, income not related or loosely related to the corporation's role as provider of intercity railway passenger services and mandated advantages in Amtrak's dealings with the freight railways. Amtrak's financial advances during its early years may be attributed to the sorry state of the system it inherited and rationalization of its network, but the corporation has now been operating for over 20 years, and improvements have continued long after rationalization was essentially complete, while VIA's cost recovery has not improved.

Without presenting definitive proof in the form of a comprehensive management audit, it is suggested that the only logical explanation is that Amtrak has made decisions that have been more focussed on improvement of commercial viability than equivalent decisions by VIA (and by successive ministers and governments for VIA) have been.[51] In essence, as a business, Amtrak has been better managed. With VIA, the key management decisions of service, price and investment have been and continue to be elements of the political process. Amtrak appears to have benefited from greater freedom and more structured and open accountability.

## 6.2 RE-EQUIPMENT AND THE LRC EXAMPLE

VIA's short history is replete with examples of decisions (for which the carrier is financially accountable) that were made through the political process for reasons other than the most cost-effective provision of railway passenger services. Among these, the effects of the purchase of the Light Rapid and Comfortable (LRC)[52] locomotive (a complete reversal of VIA's staff recommendation) are perhaps the most painful.

Although the stimulus that the development and production of the LRC had on Canadian industry may have been worth the expenditure — and this development doubtless made an important contribution to Bombardier's expansion in the world market as a supplier of rail passenger (mostly urban transit) equipment — the cost of this government industrial policy was passed on to VIA. Of course, the cost of this locomotive to VIA only started with the capital cost; when the LRC proved unable to provide quick and reliable service, breakdowns became routine, on-time performance dropped, and operating costs climbed. These locomotives, and a second order purchased after the problems were proven in practice, are now being stored until they can be unobtrusively disposed of. However, the long-run impact on VIA remains.

The LRC issue is an example of the difficulties facing both VIA itself and those in the government who must make long-term investment decisions for an organization without a long-term mandate and floating in red ink. Since the beginning, VIA management emphasized the fact that its equipment was outdated. The negative results are widespread: more spare cars and locomotives must be owned, operating costs are high, reliability is low (resulting in loss of ridership and the ability to charge premium prices), routine maintenance and servicing costs are high, and significant resources must be devoted to persuading cars and locomotives to last yet another few years.

Despite years of study, debate and negotiations, by the end of 1989, VIA was just starting to rebuild part of its long-distance fleet. There were no confirmed plans for dealing with the balance of the VIA fleet. To complicate matters, the only major fleet renewal consisted of rebuilding 1955 vintage cars at a cost in excess of a million dollars a car.

Amtrak undertook fleet renewal early in its existence, although the extent to which equipment was rebuilt and upgraded was much less than VIA is undertaking. The Amtrak fleet rebuilding was aimed at providing reasonably reliable cars while new cars were being acquired. In VIA's case, although there was little debate over the identification by the Minister's Task Force of new equipment and modernization as necessary if VIA were to provide effective service and control its deficits, the question of VIA's continued existence became the stumbling block. Is VIA to continue? If so, under what constraints and with what mandate?

## 6.3 CONSEQUENCE OF CONTINUANCE WITHOUT A LONGER TERM MANDATE

There is no question that VIA's operating costs could be reduced and ridership improved through the rebuilding or the replacing of equipment. What is not as clear is whether such investments are worthwhile in the sense that capital requirements will be less than the (present) value of the accumulated deficit reduction. Would a half billion dollar investment in new equipment provide any substantive improvement in the financial health of passenger rail, or would it merely shift the deficits from the operating accounts to the capital account?[53] More importantly, much of the potential savings attributed to new equipment was the avoidance, over the longer term, of continual costly programs of partial rebuilding, retrofitting, overhauling and generally patching up obsolete equipment. It is questionable whether this is a legitimate base from which to assert that new equipment would be a "profitable" investment. The option of eliminating these costly programs by eliminating VIA, in other words VIA's future, should be decided first on the basis of whether the benefits of a modernized VIA justify (in economic and/or other terms) the cost. Then, if longer-term retention were decided, the re-equipment question could be addressed rationally.

Investments in track upgrading, equipment maintenance facilities and stations have been made but there is some indication that a longer term commercial focus is lacking. As an example, without question there is a high demand for travel between Montreal and Quebec City, and the possibilities have obviously attracted VIA. Yet, although over $50 million have been spent on infrastructure, nothing that could compete with two uncongested freeways has been approached. The CP Rail north shore track was upgraded at a cost of at least $23 million; yet this investment was far less than would have been needed to make a real difference, and VIA does not now use the north shore track. The Gare du Palais was renovated at a reported cost of $28 million (with the Montreal–Quebec City rail trip time increasing by 30 minutes for the additional travel to the Gare du Palais). Any benefits, in terms of a truly competitive rail service between Montreal and Quebec City can only come after substantial future infrastructure enhancements (and cost). No comprehensive plan has been disclosed; perhaps different participants in the decision process have somewhat different plans and objectives.

The above is intended to illustrate the more difficult aspects of VIA's existence without a clear mandate and set of targets from which to operate. While there have been investment programs, there is an obvious lack of a long-term government commitment to modernized railway passenger services in Canada. To be sure, Amtrak has had its difficulties with funding; however, there is commitment by Congress to Amtrak and a mandate for longer term decisions. The same cannot be said for VIA. Various observers have even questioned whether VIA was created as a means of quietly getting out of the passenger rail business. Perhaps on the part of CN, it was. Now, it is for the government to decide whether to cut its losses after 10 years of a low and deteriorating rate of cost recovery, or whether to commit to passenger rail over the longer term. In the interim, there is no evidence to suggest that VIA's performance can improve significantly.

## 7. VIA's Corporate Management

While VIA has been operating in a less than ideal environment, should some part of the responsibility be laid at VIA's own doorstep? Has VIA's management performed as well as the constraints it faced would allow? The questions of VIA management's mandate and the *real* set of objectives it actually faced are important. If cost recovery and the deficit were central to the real mandate, it would seem strange that an efficient management — facing an uncertain future and a host of detractors — would make decisions that resulted in a steadily increasing deficit and a stagnant level of cost recovery. The answer here may well lie in VIA management's emphasis on such statistics as on-time performance and ridership growth.

The day-to-day signals from VIA's owner (the government) did not emphasize efficiency and cost recovery. It has been suggested that cost recovery is not in VIA's mandate, and that its management should not be judged on that. Various VIA officials have pointed out that, in 1988, they developed a cost-recovering service[54] *Rocky Mountaineer* — and that it was "taken away from them" (privatized in 1989). There is an obvious negative incentive here. Regardless of whether cost recovery and the deficit are important in VIA's objective function, however, there are clearly financial constraints on management's short-term and probably also longer term freedom of action.

Perhaps too much attention has been paid to improving service and building up a structure for the long term and insufficient attention has been paid to day-to-day business concerns. Perhaps the predominant attention has been too short-term and institutional. Perhaps management has misread signals from government or perhaps it has found no incentive for financial improvement. Again, there is the question of what was expected of VIA by the government. It is not obvious that an organization, subjected to public criticism over its on-time performance, should concentrate its efforts on cost cutting with a target of improving cost recovery from 30 percent to 33 percent. But, such a 10 percent relative improvement would be an astounding, if unacclaimed, management achievement. Yet this achievement results in little, if any, acknowledgement or reward; whereas VIA's improved on-time performance has received wide acclaim.

VIA has often been accused of inefficiency, of having too great an administrative component, of studying things to death, and generally acting like a large profitable, or perhaps well-endowed, national institution rather than as a business at the brink of insolvency. A number of points with respect to management and efficiency were raised in 1985 as part of the Minister's Task Force on VIA. VIA did not seem to have undertaken the steps that the freight railways or the airlines have taken towards streamlining at all levels over the past decade. For instance, the first major cut in administration, 205 positions, took place in 1989, and only after the government decision to reduce VIA's funding. VIA reports that these reductions were identified by internal task forces and were unrelated to the downsizing. If this is the case, why did VIA wait until the middle of 1989 to act? What other measures might have been implemented?

What might be implemented now? The cost analysis gave some clear indications in this regard; overheads are high. The belief, expressed by some VIA managers, that eventually everything will fall into place and that new equipment, maintenance facilities and so on will save the day is not well founded. However, before marked improvement can really be expected, realistic expectations for VIA must be established and management's achievements acknowledged and rewarded accordingly.

## 8. REMOTE RAIL SERVICES

VIA Rail operates rail services over eight routes which are classified as remote since these are locations without access to all-weather roads. Total ridership on these remote services in 1990 was 80,000. These passengers account for 10 to 15 percent of VIA's total subsidy. As is discussed below, however, most of the passengers on these trains are travelling to and from the more accessible points on the line where alternative transportation (the road mode) is available.

Most of the data for the following analysis were provided by Transport Canada and VIA Rail. The analysis and its conclusions are the authors'. Ridership patterns for the remote services are shown in Table 11.

Little evidence is available to explain why remote service ridership generally declined between 1985 and 1989. The important issues are:

- Is the decline largely the result of declines in ridership over the non-remote segments of these routes?
- Is the population of remote areas declining, thus reducing the inherent demand for transportation services?
- Has there been improvement in the transportation alternatives in the remote areas?
- Have the residents of the remote areas been travelling less?

The 40 percent decline in ridership from 1989 to 1990 is even more puzzling, especially since preliminary figures suggest that ridership in 1991 only rebounded on a few of these services. VIA's cutbacks and restructuring affected these services only slightly.[55] On some routes, especially Winnipeg–Churchill and Jasper–Prince Rupert, the decision to eliminate tour operations has resulted in reduced ridership. This emphasizes the fact that much of the transportation provided on these routes is not designed to meet the needs of remote residents who have no alternative means of transportation.

*Table 11*

*PATRONAGE OF VIA RAIL'S REMOTE SERVICES: 1985 TO 1990*

| | | | | | | | Change in riders (%) | |
|---|---|---|---|---|---|---|---|---|
| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 89/85 | 90/89 |
| Winnipeg–Churchill | 57,493 | 50,334 | 52,009 | 48,847 | 44,298[a] | 30,446 | -23 | -31 |
| Wabowden–Churchill | 1,631 | 1,041 | 952 | 797 | 399 | 210 | -76 | -47 |
| The Pas–Lynn Lake | 11,616 | 9,156 | 8,660 | 8,871 | 7,679 | 8,603 | -34 | 12 |
| Sudbury–White River | 8,598 | 10,423 | 9,590 | 10,195 | 9,805 | 4,715 | 14 | -52 |
| Capreol–Winnipeg | 71,643 | 65,057 | 54,616 | 54,101 | 48,479 | —[b] | -32 | |
| Montreal–Senneterre | 54,615 | 50,798 | 42,979 | 43,197 | 38,131 | 21,759 | -30 | -43 |
| Senneterre–Cochrane | 6,815 | 5,997 | 5,329 | 5,043 | 4,293 | 1,591 | -37 | -63 |
| Montreal–Jonquière | 37,295 | 34,416 | 31,350 | 31,400 | 27,248 | 11,937 | -27 | -56 |
| **Subtotal** | **249,706** | **227,222** | **205,485** | **202,451** | **180,332** | **79,261** | -28 | -40 |
| Jasper–Prince Rupert | 23,334 | 29,712 | 26,817 | 26,665 | 27,171 | 16,766 | 16 | -38 |
| **Total[c]** | | | | | | **96,027** | | |

**Source: Data from Transport Canada.**

**a This datum is 1,000 passengers greater than the equivalent figure (from another source) in Table 2.**

**b The Capreol–Winnipeg remote service has been provided by the Toronto–Vancouver train since 1990.**

**c The Jasper–Prince Rupert service was declared a mandatory (remote) service in October 1989.**

Another possible explanation of the recent decline is a change in the ticket price structure which eliminated a 40 percent discount for return fares. If this is the case, the decline in ridership would suggest that the issue of not having alternative means of transportation is not as great as it was once thought.[56]

Table 12 presents costs, revenues and deficits for the various remote services. The figures of Table 10 are based on an approximation of VIA's fully allocated costs, including depreciation but not including an allowance for the cost of capital on assets used to provide the remote services. These figures are limited to actual annual operating expenses; costs of restructuring the network following the 1990 cuts have been eliminated from the data; no allowance for future productivity gains has been included.

*Table 12*
*Remote Passenger Rail Services Subsidies*

| | 1989 | | | 1990 | | |
|---|---|---|---|---|---|---|
| | Total subsidy ($'000) | Cost recovery ratio (%) | Subsidy per passenger -km ($) | Total subsidy ($'000) | Cost recovery ratio (%) | Subsidy per passenger -km ($) |
| Jasper–Prince Rupert | 11,022 | 13 | 0.57 | 12,688 | 7 | 1.24 |
| Montreal–Jonquière | 3,799 | 13 | 0.64 | 5,587 | 5 | 1.92 |
| Montreal–Senneterre | 6,541 | 13 | 0.67 | 9,799 | 6 | 1.70 |
| Winnipeg–Capreol | 12,947 | 7 | 1.08 | | | |
| Senneterre–Cochrane | 1,671 | 4 | 3.27 | 1,927 | 2 | 11.16 |
| Sudbury–White River | 1,523 | 8 | 1.10 | 3,082 | 3 | 3.45 |
| Winnipeg–Churchill | 18,238 | 12 | 0.93 | 19,409 | 8 | 1.24 |
| Wabowden–Churchill | 97 | 5 | 1.54 | 59 | 8 | 1.26 |
| The Pas–Lynn Lake | 1,538 | 9 | 1.01 | 1,267 | 10 | 0.78 |
| **Remote subtotal** | 57,376 | 11 | 0.82 | 53,818 | 7 | 1.44 |
| **VIA total (excluding remote)** | **526,832** | **32** | **0.22** | **397,000** | **27** | **0.31** |
| Remote as percent of VIA total | 11 | 35 | 379 | 14 | 25 | 468 |

Remote services account for about 3 percent of total VIA ridership and revenues but they account for 7 to 10 percent of total workload as measured by car-kilometres or train-kilometres. This disproportion tends to reduce VIA's overall financial performance.

## 8.1 REMOTE AREAS CAPTIVE TO RAIL

One of the popular misconceptions about VIA's remote services is the actual size and scope of the remote areas served. Many of these services pass through a remote area, but few of the services are limited to only serving a remote area. In some cases, trains may serve non-remote areas simply because they must pass through them (loaded or empty) in order to gain access to a reasonable terminal location or maintenance facilities. For the most part, however, the remote services routings currently in operation are an artifact of the pre-VIA national railway passenger network and provide passengers with rail access not only to remote areas but to other areas of the country as well. When other regional services were eliminated, those that provided remote access were simply exempted. For the most part, they were not redesigned.

Routings and utilization for each remote service are described below.

**Montreal–Jonquière**

The route is 496 kilometres from Montreal. The remote area lies in the middle between Rivière à Pierre (237 kilometres northeast of Montreal) and Lac Brochette (66 kilometres southeast of Jonquière). While there is a network of bush roads and winter roads, only one location (Lac Edouard) is served by an all-weather road. No permanent population centres have been identified within the remote segment.

Passenger survey data[57] indicate that less than 40 percent of the total ridership involves travel to or from the remote segment of the route. Nearly one quarter of these remote trips involve travel to or from Lac Edouard which is served by an all-weather road, albeit a somewhat circuitous route compared to rail. There is little or no ridership between remote locations. The other 60 percent of the total service ridership is "local" traffic at the southern end of the route or riders passing through the remote area. In the case of some of these through passengers, the train may be the most direct and through route. Of the passengers to/from the remote area, most indicated that the purpose of the trip was access to a seasonal recreational residence or a hunting/fishing club. One quarter of the stops in the remote area have the word "Club" in the place name.

The rail line has a well established freight traffic base consisting mainly of long trains operating from the Lac St-Jean area to Montreal with a stop at the Garneau Yard (just west of the remote area) for a crew change.

**Montreal–Senneterre**

This route is 703 kilometres from Montreal. Only the northern 60 percent is remote. All locations south of Fitzpatrick (La Tuque) are served by all-weather roads. Most of the larger communities on the southern portion of this route have bus service. The estimated permanent population of the remote area is 2,400. The Community of Parent, with bush road access and air access, accounts for a third of the remote total.[58]

Passenger surveys suggests that 65 to 72 percent[59] of the total ridership involves trips to and from the remote section of the line. Approximately two thirds of this ridership are from the southern end of the route. The remaining one third represent trips between Senneterre and the remote area. Only 10 percent of the total ridership is trips through the remote area from Senneterre to southern destinations. The balance of the passengers using this line take "local" trips in the area between Montreal and La Tuque. Similar to the Montreal–Jonquière service, many passengers use the Senneterre service to access seasonal residences and hunting/fishing lodges. There are at least 10 such establishments listed in the timetable. The Senneterre passenger service is also used to access remote employment areas, especially for forestry.

There are reasonable volumes of freight using this line, much of it through trains between Senneterre and the Garneau Yard and beyond. Freight, especially wood chips, originates on the remote section of the line, but there does not appear to be any regularly scheduled way or local freight services which serve the entire remote section.

### Senneterre–Cochrane

The majority of the population affected by this service is in the Abitibi region of northern Quebec which comprises the eastern 156 kilometres of the route. There is a well-developed road network; all communities served by rail are also served by roads. Bus service is provided in the area by two companies. The truly remote section of the route is 60 to 70 kilometres from the Quebec-Ontario border to access points on Lake Abitibi. The final 40 to 50 kilometres into Cochrane appear to have all-weather road access. The remote area has a reported all year population of 10 plus up to 75 seasonal residents. In addition, the train provides access to Lake Abitibi for campers and tourists.

Passenger surveys showed that 60 percent of the traffic consisted of local trips within the non-remote segment of the route or trips between this non-remote segment and southern destinations via connections with the Montreal–Senneterre service.[60] Seventeen percent of the ridership involved trips between Cochrane and the Senneterre region (or more southerly points where the access was via the Montreal–Senneterre service). The balance — only 22 percent of the total passengers — were trips between Cochrane and the remote section along Lake Abitibi.

Canadian National no longer operates freight service on the remote segment of the route and had been authorized to abandon the line between Cochrane and LaSarre. The abandonment order was stayed by the Governor-in-Council in the fall of 1991.

**The Pas–Lynn Lake**

Most of the 389-kilometre route between The Pas and Lynn Lake is remote. Only the southern section (88 kilometres from The Pas to Cranberry Lake) plus a short segment near The Pas is served by road. Through bus service is available between the terminals via an alternative route. The northern terminal (Lynn Lake) has a road connection to Thompson plus air service. There is daily bus service to Thompson.

While the total catchment area has a permanent population of 13,000, only 1800 people are shown in census data as living in areas without road access. Most of these are residents of the Pukatawagan Reserve (population 1,620) 138 kilometres south of Lynn Lake. There is a public airport on the Pukatawagan reserve, but no regularly scheduled air service.

Survey data show that nearly all of the ridership involves travel to/from remote locations. Only a small fraction of trips are through trips (The Pas–Lynn Lake) or between points where there is an adjacent road. Most of the ridership is trips to/from Pukatawagan. Half of the Pukatawagan trips are to/from The Pas or Lynn Lake and half are to/from the remote areas.

Canadian National operates way freight service between The Pas and Lynn Lake once a week. The VIA cars are carried on this train. On the other two days per week, train operation is essentially the same although there are no scheduled freight cars. On these days, the train is costed as a full passenger train.

**Winnipeg–Churchill**

While this 1,698-kilometre route is often thought of as a single entity, it is made up of three distinct segments, with vastly different market and operational characteristics:

- The non-remote "southern" segment (NRS) between Winnipeg and The Pas is a 780-kilometre route. All communities served by the railway in this segment have all-weather road access and many of the larger communities are served by bus.
- The 220-kilometre segment from The Pas to Wabowden is partially served by the main road to Thompson. Of the 20 points listed as served by rail, eight have no road access and four have bush road access. The total permanent population without alternative access is 500 and is concentrated near the end of a bush road at the northeastern corner of Cormorant Provincial Park.
- The 700-kilometre segment between Wabowden and Churchill has no highway. With a population of 14,300, Thompson, Manitoba is the largest centre in this area. It is served by road from The Pas/Wabowden. There is also a road connection between Thompson and Gillam, 252 kilometres by rail. There is air service to Thompson, Gillam and Churchill. In addition, there are public airport facilities shown at Thicket Portage, Pikwitonei and Ilford. Including Wabowden, but excluding Thompson, the total permanent population along this line is 5,300.[61] Of these, less than 2,200 are without all-weather roads. Two thirds of those without road access live in Churchill.

Ridership surveys yield the following breakdown on the Winnipeg–Churchill service:

| | |
|---|---|
| Trips entirely in the non-remote southern (NRS) area | 10% |
| Trips between the NRS area and Thompson/ Wabowden/Gillam | 5% |
| Trips between the NRS area and the remote areas | 3% |
| Trips between the NRS area and Churchill | 28% |
| Trips between the remote area and Churchill | 1% |
| Trips between Thompson/Wabowden/Gillam and Churchill | 21% |
| Trips within the remote area (excluding Churchill) | 31% |
| Unknown but involving remote origin or destination | 1% |

Of the trips within the remote area, few are between centres with alternative road or air access (such as between Wabowden and Thompson). Much of the ridership in this area consists of short-distance trips between Thompson and Pikwitonei, Thicket Portage or adjacent communities.

### Jasper–Prince Rupert

Little of the 1160-kilometre route from Jasper to Prince Rupert is remote. At the eastern end there is a 185-kilometre segment centred around McBride where there are 14 railway locations listed with either no road access or only bush road access. The total population of these settlements is 110. In this area, the railway line runs parallel to the Yellowhead Highway but on the opposite side of the Fraser River. There is an 80-kilometre segment centred on Burns Lake where there are four railway locations listed with either no road access or only bush road access. The total population of these settlements is 58. Here again, the rail line is closely followed by the Yellowhead highway and it is not possible to tell how far these settlements may be from the road. Near Terrace, there is a 120-kilometre segment where there are eight railway locations without road access. The population (1 to 10) is known for only one of these locations. In this area, the rail line is on the opposite side of the Skeena River from the highway. There are also two communities (population unknown) 25 kilometres inland from Prince Rupert without road access.

Transport Canada has also identified a number of native communities with a total population of 6000 located within 40 kilometres of the Jasper–Prince Rupert line. From the available maps, none could be identified as being captive to rail.

Survey data showed that only 7 percent of the ridership on this route involved a remote origin/destination. Nearly all of these trips originated or terminated at Dorreen — population unknown — some 50 kilometres west of Terrace.[62]

### Sudbury–White River

There are 37 locations on the 484-kilometre Sudbury–White River route without all-weather road access.[63] A further two communities have bush road access. The total permanent population of these 39 points is estimated to be 316, the majority of whom are located at the two settlements with bush road access. The upper limit of the seasonal population is estimated to be 1,200. There is a developed road system in the region; however, it is one of north-south roads crossing the rail line rather than an east-west parallel road. For the most part road access between two points is more circuitous than the rail routing. No significant segments of the rail line pass through non-remote areas.

Survey data indicate that 40 percent of the ridership involves trips to/from remote points. There are few trips between remote points. A further 34 percent of the trips are between Sudbury, Chapleau and White River. These communities have alternative access. There are no origin or destination data for at least 20 percent of the riders.

**Capreol–Winnipeg**

The 1498-kilometre route can be divided into the following segments:

- The 478 kilometres between Capreol and Hornepayne pass through largely empty areas. Only 12 communities are listed along the rail line in this segment. Of these eight are without all-weather road access, although Oba has alternative rail access via the Algoma Central Railway. The total permanent population along this segment is listed as 28. The seasonal population is about 225.

- The 615 kilometres between Hornepayne and Sioux Lookout also pass through largely empty areas, although there are some populated areas with a road system. Of the 17 communities listed on the rail line, nine lack all-weather road access. All of these communities are located on the western half of the segment. The permanent population of this remote segment is estimated to be 175. The seasonal population is estimated to be about another 100.

- There are seven points along the 115-kilometre rail line between Sioux Lookout and Red Lake Road. Five do not have road access. The permanent population of these communities is less than 10. The seasonal population is 37.

- The 290 kilometres between Red Lake Road and Winnipeg is an intensive cottage and tourist area. The western 110 kilometres is well served by road. There are at least 10 locations listed on the rail line in the eastern part of this segment which are not served by all-weather roads. The total permanent population not served by road is 125. The seasonal population is estimated to be approximately 2,000. It is worth noting that the largest remote community in this region is Brereton Lake (at the entrance to Whiteshell Provincial Park). It appears to be accessible via Manitoba Highway 307 (a two-lane paved secondary road).[64] Brereton Lake accounts for nearly three quarte[illegible]e remote permanent and seasonal population in this area. There has been significant road building and upgrading in the past decade. There may be other remote communities in this segment which now have or soon will have alternative access.

At present the Capreol to Winnipeg route is served by the Toronto– Vancouver train. Thus the costs attributed to the remote service are those related to the incremental capacity, passenger handling and ticketing, station facilities, and any costs related to a slower transit time through northern Ontario due to the additional stops. In the years immediately before VIA's restructuring, the service was provided by separate trains running three-days-a-week.

Passenger survey data indicate that the traffic on this route is evenly split between the Capreol–Hornepayne, Hornepayne–Sioux Lookout and the Sioux Lookout–Winnipeg segments of this route.[65] On the two eastern segments, roughly one third to one half of the trips involve a remote origin or destination. On the western segment, most of the trips appear to be between Winnipeg and the remote cottage/lodge areas. In general there is little or no traffic between remote points and little travel between locations in the individual segments. It is worth noting that in 1989 the average length of a passenger trip on the Capreol–Winnipeg service was 250 kilometres — far longer than is necessary to provide remote access.

Property owners who depend on VIA Rail to provide weekend train service to their camps are dissatisfied with the present Tuesdays, Thursdays and Saturdays arrangement. The campers and their association are petitioning VIA for regular dependable weekend train service.[66]

## 8.2 REMOTE ACCESS ISSUES

The apparent rationale for continuing to provide these remote rail passenger services at a subsidy per passenger-kilometre five times higher than the national passenger rail average is the notion that the populations so served have no adequate alternative means of transportation, and that they have an entitlement to continuation of rail service.

But, what is meant by "adequate alternative means of transportation"? Is direct road access the criterion? Does having access require public transportation? Must this be scheduled surface transportation? Is regularly scheduled common carrier or charter air service, at a much higher ticket price than rail or bus, an adequate alternative? If one considers scheduled bus service, how close must the bus stop be to be considered an adequate alternative means of transportation? There are many communities in Canada which might be classified as remote by applying the criteria implicit in VIA's services.

Does an adequate alternative require there to be common carrier service or simply alternative infrastructure — road or airport — to allow access? How do the most used forms of transportation in most of the communities involved — boat and snowmobile — fit in?

In the same vein, does any obligation to provide adequate transportation in remote areas require the provision of rail service from each remote location to anywhere in the national system or merely from the remote location to the nearest community with road or air access? Is the obligation to provide transportation the same to "true residents" of remote communities or to anyone who wishes to go — including tourists, cottagers and hunting parties? In this case, the distinction blurs since the tourists, cottagers and hunters may be necessary to support the livelihood of the "true" residents of a number of remote communities.[67] Is there an obligation to provide rail service where it may be significantly more direct and convenient than road service?

Another consideration with respect to remote services is the type of passenger. In some communities, the main employer is the (freight) railway. Indeed the community may only exist to support the railway function. Even non-railway employees may only be there because of the railway. Is the provision of passenger transportation to such communities an obligation of the government or (as before VIA was created) an obligation of the railways? Clearly, access for employees is part of the normal cost of operating railways in remote areas.

There is no obvious point at which the provision of public passenger service becomes a necessity. What is clear, however is that many users of the present remote railway services travel between points where there are apparently adequate alternatives that would be considered entirely reasonable in other contexts. Yet, provision of similar levels of service in areas where there is no remote aspect has long since been discontinued.

## 8.3 OPTIONS FOR REMOTE SERVICES

With reference to the above issues, in the discussion that follows, the main assumption is that publicly supported remote rail passenger services should be limited to what is necessary for the remote areas. The services should be designed to bring the passengers out to the closest convenient point where transfer can be made to some other mode. Usually this would be a local community with road access and scheduled bus service. Such a community would generally also have services, particularly shopping, that many remote residents would wish to access regularly.

It makes little sense for passengers to be moved at high cost for hundreds of kilometres by rail where there is a parallel road and bus service that affords a convenient connection for a short and relatively economical rail trip into the remote area. Also, continuing rail operations need not always be the most effective and economical way to provide remote access. Air or road infrastructure may be more appropriate in some circumstances.

Presuming that it is decided that there is some need, however defined, for railway transportation in remote areas, there is also a well recognized need to reduce the net subsidy required for these services.

Given the nature of the services, there is not much scope for improving cost recovery through revenue enhancement. A doubling or even tripling of revenue would not greatly reduce the subsidy requirements. In most cases, a market does not exist for improvements and much of the incremental revenues would be consumed by the incremental costs of providing a service that would attract additional ridership. Thus, any control of subsidies must come more from the reductions in the extent of the routes and the control of costs.

### The Mixed Train Alternative

Given the present institutional arrangements, the mixed train alternative is the least cost method of providing railway passenger service in remote areas. As late as 1955, CN listed 90 to 100 routes in its timetable where mixed train services were offered. A mixed train is simply a freight train with passenger cars. Where demand is very light and a caboose is still used, a separate passenger car might not even be required.[68] Compared to a conventional passenger train, the direct operating costs charged to VIA of a mixed train could be 75 to 80 percent lower. There is no technological reason for this difference, the freight railways historically have simply not charged for crew, locomotives and track access. They have only charged the incremental fuel and maintenance costs of the passenger cars.

Even if the railways were to charge for crew, locomotives and other expenses on a fully allocated basis, the mixed train would be financially attractive compared to the operation of a passenger train. The advantage is that one train could be operated instead of two separate trains, resulting in a reduced requirement for crews and locomotives.

The mixed train alternative is presently used only on the weekly Wabowden–Churchill service and on some of The Pas–Lynn Lake runs. Why are mixed trains not used more? There are a number of reasons:

- Passenger service must be provided on a fixed schedule. On many routes the way freights operate on an as and when needed basis. Thus it may be impossible to schedule the service.[69]
- The way-freight service must cover the section of route that a passenger train would cover. Often way-freight assignments do not match the passenger routes.
- The mixed train service must be provided by a way freight or other local train. There may be through freights that meet the geographical criteria and operate on a sufficiently regular schedule. However, there are often practical and commercial issues which make stopping a 5000-tonne express freight every 15 kilometres for passengers inappropriate.
- There may also be a concern of providing passenger transportation in trains handling dangerous commodities. Gasoline, chlorine and similar substances may often be handled on way freights.

There appears to be little potential for a reasonable replacement of many of the present remote passenger trains with mixed trains. This is due primarily to the fact that there are now only a few regular way freights. CN and CP traffic patterns should be reviewed in detail before the mixed train option is completely discarded. A much better fit between freight and passenger may exist if passenger service is only provided between truly remote areas and the closest centre tied in with the rest of the national passenger transportation system. Perhaps some incentive might be offered to the freight railways to harmonize local freight with such passenger operations.

While the mixed train option may be the least expensive means of delivering remote services, it must also be recognized that it may also be the least convenient means as well. Trip times will be longer to allow for switching and other activities and the ride quality may deteriorate. These considerations must be balanced against the costs.

## 8.4 ANALYSIS OF INDIVIDUAL ROUTES

This section examines, in a very preliminary way, the circumstances of each of the present remote services based on the apparent requirements for remote transportation discussed above.

One of the most striking ramifications of the analysis is a questioning of whether VIA is the appropriate vehicle for delivery of remote rail passenger services. With few exceptions, a restructured (remote service only) route would not be physically connected to VIA's network. The nature of these services is such that the use of VIA's marketing, reservations and customer services expertise may not be necessary, and VIA would simply become an administrative intermediary between the government and the actual operating railway. In some ways it may be necessary to undo some of the changes that have taken place through the implementation of VIA Rail. For example, it is probably more effective to draw on the existing CN crew rosters to operate passenger trains in northern Quebec rather than maintain a separate set of VIA crews in the area.

### Northern Manitoba

A detailed examination of all instances of subsidized remote rail passenger travel is beyond the scope of this preliminary analysis. However, use of the Winnipeg–Churchill service as an example should illustrate the issues involved, and their possible resolution.

There are three reasons for the selection of Churchill as the example:

- Churchill is the only substantial Canadian community (approximately 1,200 residents) with rail but no road access.

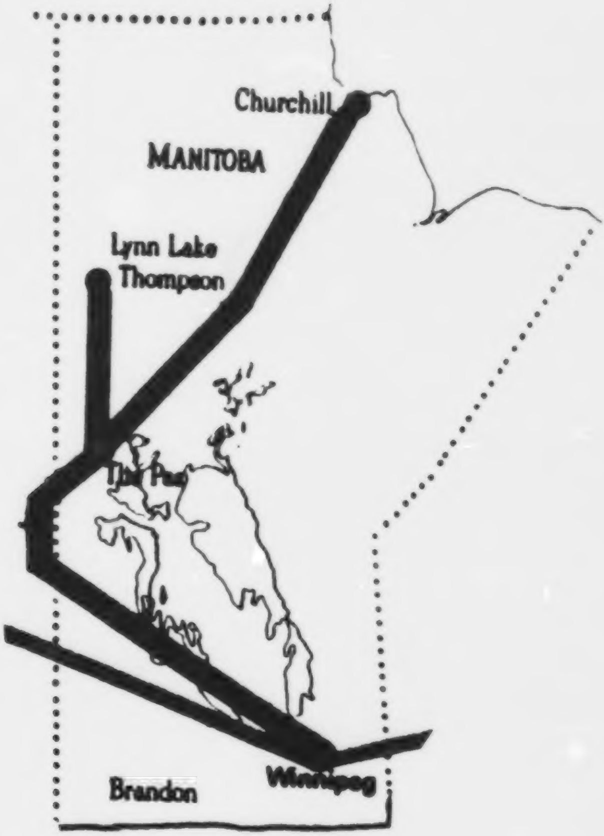
- At $19.5 million in 1990, Churchill services require the largest single remote rail subsidy. Excluding Jasper–Prince Rupert, which is not really a remote service, the Churchill services account for almost half of total remote rail subsidies.
- Churchill has two quite different rail services. A full service (including dining and bedroom facilities) train operates over a 1700-kilometre distance from Winnipeg. A mixed freight and passenger train only goes to Wabowden (through Gillam). Gillam, only 300 kilometres south of Churchill, has regular bus service to Winnipeg.

With costs allocated on the basis of revenue, the transportation of a passenger from Winnipeg to Churchill, including basic sleeping accommodation,[70] costs $3,000; the cost to the passenger is $230 (plus GST). The cost for a passenger willing to sit up for two nights is $2,050, and the fare is $157. Scheduled time is 35 1/2 hours. The regular one way air fare is $353 (including Air Transportation Tax (ATT) but not GST); discount excursion fares start at $331 return. The rail fare for the 6 1/2 hour trip from Gillam to Churchill is $40; bus from Gillam to Winnipeg costs $91.35 and takes 15 hours for bus-rail totals of $131 and 24 1/2 hours (including a three-hour wait in Gillam).

Intervenors at the Commission's hearings included the Churchill Development Board. Its presentation focussed on the importance of long-term continuance of an improved railway passenger service with an upgraded rail bed to the town's tourist industry. Specifically requested were: additional sleeping cars in the summer, replacement of the cafe/lounge car with a full dining car and a dome-type observation car, group discounts, and an improved reservation system tailored for tour operators. Use of passenger rail by the town's residents was not mentioned.

Almost all, if not all, use of the rail service by persons lacking alternative transportation (at least four-wheel drive access to within a few kilometres for most of the year) are located north of Wabowden. They are served by the weekly mixed freight and passenger train from Wabowden to Gillam, continuing the next day from Gillam to Churchill. Continuation of this service but elimination of the train to Winnipeg would save approximately $20 million in subsidies annually, or $1,650 per year for every resident of Churchill, many of whom rarely, if ever, use the train.

*Figure 5*
*VIA Rail Remote Services in Manitoba*



The Wabowden–Churchill operation cost $105,000 in 1990. To the extent that former riders of the Winnipeg train used it, and no increase in capacity was required, the cost recovery for this service would rise. At the 1990 average of two passengers per train run, capacity is not a problem; however, addition of another passenger coach to the freight train should be achievable at modest (less that $100,000) cost. Even were it decided to increase mixed train service to thrice weekly, or operate short daylight passenger trains, estimated subsidy, of the order of $2 million annually, would represent a 90 percent saving over present levels.

This points out one of the most obvious issue with respect to the Winnipeg–Churchill: *Is there a need for a rail passenger link between Winnipeg and northern Manitoba at all?* Nearly half of the route has no remote component. Serious consideration must be given to moving the southern terminal of the route to The Pas, Wabowden or even Thompson. This would eliminate a significant part of the operating costs of the service, but would require some expansion in maintenance and servicing facilities in the North as well as some periodic non-revenue movements to Winnipeg of passenger equipment for maintenance. On the other hand, service could be provided with a single trainset rather than the two trainsets presently required.

Given that much of the demand in this area is for local service in to and out of Thompson, consideration might also be given to the operation of a separate local service in the Thompson area, perhaps connecting as far as Gillam and reducing the number of through passenger trains to Churchill. Experiments with various railbus technologies in the mid 1980s in this area, confirmed the potential for such a service.

As noted above, northern Manitoba is a special case. Unlike any other route, the far terminal — Churchill — is without road access. The passenger train is also used to provide intermodal freight service to Churchill, from Thompson, however, not Winnipeg. With the exception of grain trains, the sole purpose of the line to Churchill is to provide remote access. If the rail line is to remain at all, there is no reason to impose an artificial separation between the provision of general freight and passenger service as well as the maintenance of the infrastructure itself. One unified operating entity should be established in this area. The Churchill line is also a case where billing some of the cost of the infrastructure through the passenger system creates a somewhat artificial cost structure. As much as 20 percent of what VIA pays in avoidable costs are charges from CN for infrastructure use. This is simply part of the cost of maintaining an operational and operating line to Churchill.

While the focus should be solely on the provision of service on the northern segment of this line, VIA's recent experience has demonstrated that there is some opportunity to commercially exploit an upscale rail tourism market to Churchill. A tourist section might well be operated during the summer and potentially could contribute to the cost of providing the basic service.

Exploitation of any such opportunity should be a separate commercial venture. Certainly, it should not be an integral part of a heavily subsidized remote access operation.

### Jasper–Prince Rupert

If a through rail passenger service between Prince Rupert and Jasper is to be maintained as part of western interprovincial services for tourism or other reasons, then serving the few remote locations with this train as is presently done would be the most cost effective means of service delivery. The incremental costs to serve these remote areas appear to be minor. Remote service, however, should not be the driving force behind maintaining the present long-distance service.

Given the apparent demands for remote access, service could be provided by mixed train, provided there are sufficient scheduled way freights between Prince George and Jasper and between Prince Rupert and Smithers. There is no evidence, however, that the appropriate freight trains exist. As an alternative, rail diesel car service[71] could be provided in these two areas at a cost significantly less than the present service. This would leave only the four communities near Burns Lake (total remote population 58) to be accommodated.

It would also be of value to examine the transportation demand and alternatives in more detail. Some areas might be better served by road or air. Some of the areas may not be as remote as thought. The survey data raises serious questions as to whether there is a need for any form of rail service to the areas identified as remote.

### Senneterre–Cochrane

On this route, it appears clear that there is no need to provide a through service to provide remote access. The northern end of Lake Abitibi can best be served from Cochrane. There appears to be adequate alternatives between Senneterre and Cochrane, and the Abitibi area of Quebec is well served.

If rail is to be used, it would be necessary to acquire some 90 kilometres of track from CN and undertake some investment in upgrading.[72] The Ontario Northland Railway — either in its own right or as an agent of the Government of Canada — would appear to be the appropriate vehicle for operating this segment. VIA has no presence in the Cochrane area. The ONR has a significant presence in the area and has already acquired CN's line running west from Cochrane. It could be expected that the ONR could potentially operate a service at little incremental expense. With a short distance and no freight, it might also be possible to avoid or postpone line upgrading costs. With no freight traffic on the line, it might also be possible to use some form of modified non-standard railbus rather than conventional passenger equipment.

A road alternative has also been identified by the Ontario Ministry of Transportation as being feasible. Upgrading costs are estimated at two to seven million dollars.

### Montreal–Jonquière

If only the remote areas are to be served, a train could be operated out of the Garneau Yard — the closest convenient crew change and equipment layover point. Such a change would cut the route length nearly in half. In this instance, there appears to be little scope for a mixed train. Nearly all freight movements consist of long, fast non-stop trains which are unsuitable for mixed train operations.

An alternative consideration would be the use of one or two upgraded rail diesel cars at a capital cost of two million dollars each to replace the one locomotive and three or four conventional cars presently deployed which eventually will require major upgrading or replacement. Depending on crew on-duty time limits, it might be possible to cover the remote area and return in a single day.[73] Such an option may require some expansion in equipment facilities at Garneau to accommodate routine servicing of the equipment. This type of option is estimated to substantially reduce the operating subsidies compared to the present system. The capital costs of providing RDCs are likely to be the same or lower than what will be required eventually for the present service.

A road alternative might also be considered. Unlike the Senneterre–Cochrane case noted above, this option would require a substantial road building/upgrading program rather than marginal upgrading in one specific area.

### Montreal–Senneterre

The issues related to providing remote service on this route are similar to those on the Montreal–Jonquière route. There appears to be an existing service between La Tuque and Senneterre — two established crew change points. From an operational point of view, the use of Senneterre as a base of operations would be attractive since it is CN's major centre in the area with some equipment servicing capability. Freight traffic between Senneterre and La Tuque is such that the use of mixed trains may be possible. There is no evidence, however, that the appropriate way freights now exist although some of the operating savings of a mixed train might be offered as an incentive to CN to restructure its freight system to provide the schedules required for such a service.

In the event that mixed trains do not prove feasible, the use of short self-propelled equipment which can provide reliable operations in winter conditions would contribute to reducing operating expenditures.

### Sudbury–White River

Given the use of separate passenger trains, there are few options that might prove significantly less costly than the present three-day-per-week operation. No segment of the route could be dropped without abandoning some remote communities. Neither road or air alternatives appear to be any less expensive.

This route points out the issue of balancing the costs to the public of providing remote services against the convenience and needs of the users of the service. At present, a passenger cannot go to one of the regional centres and return on the same day, and many trips to White River or Chapleau may not allow the traveller more than an hour in town during business hours without an overnight stay. At least one proposal has been identified which would address this problem. While some of the additional cost could be recovered from increased revenues, how much extra public cost can be justified to provide convenient service, especially where half of the ridership may not be truly remote without alternative access?

### Capreol–Winnipeg

As with the Jasper–Prince Rupert service, the present method of serving the remote areas in northern Ontario by the Toronto–Vancouver interprovincial train is probably the lowest cost alternative. In the long term this presupposes the continued operation of a transcontinental train. The remote service may be one of the factors considered in any decision regarding Toronto–Vancouver service, but not the determining factor.

In the absence of the Toronto–Vancouver train — or other through train — some form of mixed strategy appears to be worthy of consideration. Some remote locations might be served by careful attention to road upgrading and expansion. Other seasonal, primarily tourism locations, could be served by air.

Since the primary demand for rail service appears to be for short-distance trips, some form of regional self-propelled or mixed train service operating out of Capreol, Hornepayne and Sioux Lookout appears to offer scope for an improvement in costs. Forestry and mining are listed as primary activity at some remote locations. This would indicate that some form of local freight service exists.

At the Winnipeg end, serious examination must be made as to how remote many of the cottage locations actually may be and what type of road upgrading may be necessary to provide access similar to that provided to other cottage areas in Canada.

## 8.5 REMOTE RAIL POLICY

The above examples, or rather some of the potential resolutions, presume general principles and definitions with respect to remote community access. Such access can be defined in two dimensions:

- access to the highway network; and
- access to public transport.

Most of Canada's population has both; some communities have only one; a few Canadians have neither. Public transportation for Canadians with road access but who cannot afford or who cannot drive a car, among whom the elderly are prominent, is one issue. With respect to Canadians who lack access to the road network (the remote rail issue), any responsibility would logically seem limited to persons who have had public mode (rail) service for a sustained period. The responsibility would also be limited to the most economical basic coach and baggage service to a point where onward public (usually bus) travel is available.

Where publicly provided road infrastructure is available, this is deemed by most as adequate access for very small settlements. Where there is no direct road connection, however, it would be unreasonable to assume the ownership of a car once the person is transported to a point on the road system. Adequate connection into the transportation network is normally an affordable public mode connection. A decision to assume responsibility for the access of persons captive to rail does not necessarily mean that the persons concerned have a right to continued transportation service. Responsibility can also be resolved through compensation.

Where abandonment of a passenger rail service leaves communities without direct road access, the size of the community (permanent residents, defined as 10 months of residence over each of the last two years) and the availability of other transportation should be assessed. Transportation, in this context, would include four-wheel drive vehicle access, snowmobile tracks and boat access to/from all-weather roads or points with air access; such modes may (even with train service available) be used a great deal more than the train. For communities where the principle *raison d'être* is the railway itself and its maintenance, access via high-rail vehicle, freight trains and work trains would also be considered. It would then be decided whether communities losing passenger-rail service will be left with access inferior to the norm for generally equivalent communities without road access (that never had rail) — essentially, whether communities are rail dependent.

Financial compensation of those residents deciding to relocate would be negotiated where allocation is more economical than continuance of the rail service. Financial compensation of rail-dependent seasonal businesses whose owners elected to abandon them could also be considered.

## 9. PERSPECTIVES FOR VIABILITY OF VIA SERVICES

*How viable are VIA's individual services in the long term? Could any of the services recover costs from passenger revenues?*

The Toronto–Ottawa–Montreal services seem to offer the greatest prospect for viability. Results of the cost analysis for a projection of the status quo, service, however, show that even this service, with new equipment and a 25 percent increase in ridership, would at best recover just over half of total costs (including cost of capital). Hypothetical inclusion of green credits[74] would, even at an optimistic five dollars a passenger, only increase the level of (full economic) cost recovery to two thirds.

Judging from the Amtrak experience in the northeast corridor, a very substantial increase in ridership and/or in ticket prices (most likely ticket prices) would still be necessary. However, it is unlikely that increases much more than those projected in this paper could be realized without fundamental change in the service package.

Such change would require a very large investment in new and upgraded track and different equipment to allow Toronto–Montreal operations through Ottawa at present or lower transit times. This would allow for a potential increase in frequency to eight trains per day between the three major centres without any significant increase in fleet size and with an important improvement in trip times to Ottawa. However, an investment in reducing Montreal–Toronto trip times might be as effective; however, it is unlikely that either investment would be economically justified. The combination of the two — a high-speed Toronto–Ottawa–Montreal rail system — is the topic of exhaustive study. For an economic return on the capital investment required for such a system to be achieved, ridership and yield would have to increase much further.

The situation in the Montreal–Quebec City market is somewhat more perverse. While there is substantial travel demand between the two centres, the presence of two relatively uncongested (outside of suburban Montreal) freeways results in a low market share for rail, and it puts a limit on the potential for increasing rail ticket prices. Also, although there are also two rail lines, the one that is well situated for a speedy Montreal–Quebec City passenger connection is not constructed to suitable standards. Substantial infrastructure investment would be required to allow VIA to penetrate the car and bus dominated market.

Regardless of improvements, cost recovery levels for Montreal–Quebec City must be expected to continue to substantially lag behind those for Montreal–Toronto. Since these are connecting services, and partially integrated in terms of operation, a case can be made for crediting some potential Toronto–Montreal revenue to a Montreal–Quebec City upgrading. As with the size of the connecting rail traffic, any such credit would be small. More significant is the case for political symmetry — a system upgrading that links the capitals of Ontario and Quebec with the nation's capital.

As noted earlier, the railway passenger mode in southwestern Ontario is dominated by traffic into and out of Toronto from much smaller communities and thus can never hope to achieve high average load factors. The use of different equipment and organizing the service delivery more in line with commuter operations would no doubt allow an improvement from the 36 percent cost recovery level projected in this paper, but 100 percent is difficult to conceive, except possibly for a dedicated London service. In this context it is noted that, while there may be a Quebec City–Toronto corridor, there is really no Quebec City–Windsor corridor in the sense that, west of Toronto the service is better characterized as a local network of three services terminating in Windsor, Sarnia and Niagara Falls. The major communities served are not oriented linearly, and little of the traffic is destined to the east of Toronto.

If there is a key ingredient with respect to possible improvements in the viability of southwest Ontario services it would seem to be the progression of congestion on the local intercity highways, and its effect on the fares that travellers will pay to avoid it. A large (unrealistic) fare increase would be necessary to make existing rail services viable. An alternative would be subsidies contributed by government, presumably the province, in the name of congestion abatement; however, the cost of avoiding congestion would be high, and there would be equity concerns. In general, the economically advantaged use the train while those with low incomes ride the bus.

Western Interprovincial services can be expected to improve somewhat from present levels, but recovery of much more than one third of total costs is unrealistic for a true transcontinental transportation service. The Amtrak experience is much the same. In this sector, the inclusion of green credits would not markedly affect viability; the difference between rail and other modes is simply not that significant. When considering the general issue of credits, it would be worthwhile to include a separate credit for any remote service that is provided by these trains. This would not be of consequence in terms of the viability of the service beyond the remote region.

It would only be considerations of linking east and west (nation-binding) and of the promotion of tourism that might tilt an analysis and decision on the western services in favour of retention. The financial viability of the train services will augur against it. As noted earlier, tour trains can be viable in the western market, but the factors that lead to their financial viability (catering to upper-income travellers and offering limited service frequency and destinations) may not be considered factors that justify public subsidy, ownership and operation of the transportation service. Further, the operation of a tourism service in order to subsidize basic east-west and western intercity rail transportation would seem neither feasible nor appropriate.

VIA's analysis of the western services is quite similar to ours. For the next decade, VIA offers two options, both of which rely heavily on tourist services between Jasper/Calgary and Vancouver. One option includes the retention of a year-round Toronto–Vancouver train three days per week plus three-day-a-week, summer-season tourist service on both the CN and CP routes through the mountains. VIA expects that such a service package could recover 60 percent of total operating costs assuming sustained growth in ridership and real fare increases. This option would require new capital investment of some $140 million to provide additional train capacity and replace the present recently upgraded fleet. Inclusion of the capital would result in less than 50 percent total cost recovery. VIA's second option features daily tour train service on both mountain routes during the summer season only. Capital requirements are modest — only $30 million. VIA anticipates that the tourist-only option would generate a modest operating profit, but the total cost recovery, including capital, would be in the range of 90 percent in the initial years.

Commercial prospects for the eastern interprovincial services are much the same as in the West, except that there seems to be very limited tourism potential. Due to market factors, financial performance in the East is likely to always lag behind the West, and as with the West, inclusion of green credits is unlikely to improve viability to the extent that it might for Toronto–Montreal services.

Another factor at play in the East is the generally declining level of total railway activity and profitability. Already, some of the track used by these services has been approved for abandonment; other line segments may follow. In such a situation, increases in the attribution of infrastructure expenses to the passenger services will be necessary.[75]

In the East, VIA has examined the option of a single daily train between Montreal and Halifax via Campbellton with the elimination of rail service to both Saint John and the Gaspé. Assuming moderate traffic growth but no real ticket price increases, VIA estimates that this option could result in an operating cost recovery of just under 50 percent, with much of the financial improvement coming from the cost savings associated with consolidation of the present three train services. Inclusion of capital would bring the total cost recovery down to less than 40 percent. VIA also estimates that there may be some tourism potential in the East, but not enough to significantly alter the financial results.

Financial viability *per se* is not the issue with VIA's remote services. Such services are (or should be) only provided on the presumption that access alternatives to a subsidized rail service are either absent or would be more expensive. Thus the key questions for remote services are: *How can costs be controlled?* and *What is the lowest cost method of providing these services?* In some cases, non-rail alternatives may be the answer. In other cases, it appears that significant savings can be made by eliminating the long-distance trains in favour of trains which serve only the remote areas. In some cases, more use of mixed trains may be in order. However, the potential in this area is limited.

## 10. THE COST OF ELIMINATING SERVICES

The discussion above indicates that few if any of VIA Rail's services have significant prospects of viability without subsidy. The very mention of this topic suggests that some or all of the services might not be continued. In this context it is recognized that discontinuing such government provided services has its own cost. The present section develops an order of magnitude estimate of the one time cost required to terminate the Canadian intercity railway passenger network and the operations of VIA. The cost would depend on the way the system was wound down. It is assumed for this analysis that any termination would be done in an orderly, well-timed fashion — say over a year — rather than abruptly.

The cost of termination is estimated to be $556 million — plus the budgeted subsidy for the year of termination — and would fall into the following categories:

| | |
|---|---|
| Severance/assistance for labour | $ 407,000,000 |
| Terminating day-to-day supply and other contracts | nil |
| Terminating leases | $ 20,000,000 |
| Clearing any unfunded pension liability | $ 34,000,000 |
| The actual winding down of the company | $ 25,000,000 |
| Losses in revenue for trains still operating | $ 70,000,000 |
| Mitigation of environmental damage at facilities | undetermined |

Against these costs a credit must be given for the net proceeds upon disposal of VIA's assets. An overall value on the order of $250 million seems appropriate for this credit. This value includes:

| | |
|---|---|
| Sale of cars and locomotives | $ 68,000,000 |
| Disposition of infrastructure | nil |
| Disposition of stations | $100,000,000 |
| Disposition of shops | $ 75,000,000 |
| Disposition of other assets | $ 10,000,000 |

Each of these costs and credits is discussed below.

## 10.1 LABOUR SEVERANCE

A number of VIA's unionized employees, with eight or more years' service, have labour protection clauses in their collective agreements which amount to what might be considered a lifetime guarantee of employment,[76] provided that the employee "remains available for work." These guarantees apply to shopcraft employees and to non-operating employees (clerical, station, on-train staff and some support staff). The running trades (train and engine crews) do not have the same form of contractual job security. Instead individual agreements are negotiated in each instance under the material change provisions of the collective agreements. United Transportation Union (UTU) officials expect that settlements for the running trades would be similar in value to those obtained by other unions.

Many of VIA's employees, especially those with the employment guarantees, are former CN employees who were transferred to VIA between 1978 and 1988.[77] Seniority and years of service for all transferred employees date from the time the employee first entered CN or CP service. The transfer agreement between the railways for non-operating employees, on-board service staff and shopcraft employees provides no residual rights to return to CN or CP. For the running trades, the agreements provide that all former employees are entitled to return to CN in the event that they "can no longer hold work" at VIA. Presumably the closure of VIA would be a valid reason for not being able to "hold work," which could lead to a situation where the closure of VIA led to layoffs of CN employees. This is not considered here.

Based on the pre-cutback distribution of employees, between 35 and 40 percent of VIA's projected 1993 work force of 4,200 employees may be entitled to some form of job protection or employment security benefits. This would apply to about 1,600 employees. The distribution by age group is not known, although many of the protected employees would be older than the average. For the purposes of the analysis, it is assumed that the one-time cost to terminate these employees would average $210,000 per person. This represents an average of seven years' payment at a rate of $44,000, discounted at 10 percent. This totals $336 million.

This value of $210,000 per person may be high. For the termination of the Newfoundland Railway it was reported that employees with job protection would average seven years' pay. No confirmation has been found for this number and it must be noted that a number of the affected employees could exercise seniority rights in other locations in the Maritimes or could be reassigned (after a four-year moratorium). VIA in its calculations for its *1989 Review* adopted the seven-year figure.

In late 1991, CP laid off over 1,200 employees with the closure of the Angus Shops in Montreal. All employees with more than eight years' service were to receive full wages and benefits until retirement. No specific cost for the labour settlement was reported by CP. However, CP included a $250 million extraordinary charge against 1991 earnings for work force reductions in the shop and administrative areas. As part of its overall package, CP offered $100,000 cash settlements for employees that chose the alternative of leaving the company. Older employees were offered early retirement incentives. Employees for which CP had employment elsewhere and that chose to relocate were offered bonuses of $45,000.

One of the ways to reduce this cost might involve the reintegration of VIA with CN. While separate freight and passenger collective agreements would remain intact, it is not unreasonable to expect that CN might negotiate an agreement that allows it to recall former passenger employees on labour protection as it needs these skills.[78] This would result in significantly reduced net severance costs. CN may also be able to use a number of the other skilled employees now employed by VIA.[79]

It is assumed that the one-year notice of the termination of VIA — including an allowance for full wages of all staff during this period — would serve as the equivalent of a severance package for other classes of employees. This is not to say that employees would receive severance pay as required by law. Instead, it is assumed that operations and administrative activity would be scaled back over the year and that employees would be terminated throughout the year.

In the case of the Newfoundland Railway, the average severance package in 1988 for employees without job security was $40,000. CP, on the other hand, appears to have made no special provisions for the few workers at Angus with less than eight years service. If the Newfoundland experience were a precedent, an additional allowance of up to $50 million (2,000 employees at $25,000) might be made for additional severance packages.

As an additional item, it can be expected that there would be various retraining, counselling, and out-placement programs provided on a ongoing basis during the termination period. At a net average expenditure of, say, $5,000 per employee, this cost would be $21 million.

## 10.2 SHORT-TERM CONTRACTS FOR SUPPLIES AND OTHER SERVICES

It appears that most of VIA's contracts for materials are short-term contracts. Given the one year winding down period, there would probably be no net costs of termination since adequate notice could be given.

## 10.3 TERMINATING LEASES

In its analysis for the *1989 Review*, VIA used a cost of $26 million to terminate long-term leases. This seems a bit high, and one can assume that there may have already been some reductions in this area due to the past downsizing. A cost of $20 million is suggested.

## 10.4 UNFUNDED PENSION LIABILITY

Note 2 of VIA's 1990 *Annual Report* suggests that there was some unfunded pension liability. Note 8 states that the accumulated benefits were estimated to be $634 million as of the end of 1990 while the market value of the available pension assets was $600 million. The difference, $34 million, has been used as an approximation for this cost.

In addition to the costs of clearing the unfunded pension liability, a one-time payment might also need to be made to provide for ongoing administration of the pension system. No provision had been made for this cost.

## 10.5 WINDING DOWN THE COMPANY

Since it is assumed that one year's notice would be given of any termination, much of the executive and administrative effort presently devoted to training, product development, long-term planning and so forth could be devoted to the mechanics of winding down the company. There would still be other expenses and effort would continue past the end of the one year notice period. A value of $25 million has been used for these costs. This is equal to approximately half of VIA's total 1990 administrative costs. As suggested above, this task might reasonably be given to CN which has experience in this field.

## 10.6 PREMATURE LOSS OF TRAFFIC

Ridership will start to drop off as soon as any decision to terminate VIA is announced. It will also drop off as services are terminated throughout the transition year. It is unlikely that VIA would be able to reduce costs to match the drop in ridership, especially if it is assumed that the one year termination period and notice subsumes severance and other costs of termination. A value of $70 million is suggested as the loss in revenue for the transition year. This is equivalent to half VIA's 1990 revenues.

## 10.7 MITIGATION OF ENVIRONMENTAL DAMAGE

Under current legislation, it would be necessary for VIA to clean up any sites it had used. No estimate has been made for this item. It might reasonably be expected that clean-up costs would be reflected in the realizable value of contaminated properties rather than as a specific direct cost.

## 10.8 SALE OF CARS AND LOCOMOTIVES

The net realizable value of VIA's fleet varies from scrap values for the very oldest cars and locomotives to potentially three quarters of a million dollars for its newest locomotives. Potential buyers for equipment include shortline railways, tourist railways, railway museums, and even freight railways which use passenger equipment for work trains. Some of the equipment might also be transferred to any entity that is charged with the responsibility for operating any residual remote services.

It is assumed that the costs of disposal would be at least 15 percent of proceeds. The following valuation (based on VIA's 1990–1993 fleet projections published in its June 1990 Corporate Plan) is suggested:

*Table 13*

*VIA RAIL ROLLING STOCK: ESTIMATED DISPOSAL VALUE*

| **Equipment** | **Manufactured** | **Replication cost ($)** | **Fleet size** | **Disposal value ($)** | **Subtotal ($)** |
|---|---|---|---|---|---|
| F40 locomotives | 1986 through 1990 | 2,000,000 | 59 | 750,000 | 44,250,000 |
| LRC locomotives | Early to mid 1980s | 2,000,000 | 10 | 100,000 | 1,000,000 |
| GP418 locomotives | Rebuilt mid 1980s | 1,000,000 | 15 | 200,000 | 3,000,000 |
| Other locomotives | Mid to late 1950s | | 14 | 20,000 | 280,000 |
| Steam generators | Mid to late 1950s | | 60 | 15,000 | 900,000 |
| Rail diesel cars | Recently upgraded | 1,000,000 | 5 | 250,000 | 1,250,000 |
| LRC cars | Early to mid 1980s | 1,750,000 | 109 | 50,000 | 5,450,000 |
| Stainless cars | Upgraded 1988 to 1992 | 1,100,000 | 80 | 250,000 | 20,000,000 |
| Stainless cars | Mid 1950s | | 80 | 25,000 | 2,000,000 |
| Old blue cars | Mid 1950s or earlier | | 220 | 10,000 | 2,200,000 |
| **Subtotal** | | | **652** | | **80,330,000** |
| | Less 15% allowance for disposal costs | | | | 12,049,500 |
| **Net estimated proceeds (including parts)** | | | | | **68,280,500** |

## 10.9 DISPOSAL OF INFRASTRUCTURE

VIA owns little track. It is assumed that the net proceeds on disposal would be low. For example, VIA owns the track from the outskirts of Ottawa to the outskirts of Smiths Falls. This track is no longer required for freight traffic and does not occupy any seemingly valuable land. Much of VIA's investment in track has taken the form of paying for specific improvements made to the CN and CP tracks it uses. There would be no assets to directly dispose of.

## 10.10 DISPOSAL OF STATIONS

VIA owns a variety of stations, ranging from major properties in Halifax, Quebec City,[80] Ottawa, Winnipeg and Vancouver to hundreds of small line stations. The largest and most valuable, Toronto and Montreal, are not owned by VIA and are also used by urban commuter services.

There are a number of unknown factors here. Does VIA own all the land occupied by its stations or is it leased from the railways? Do the facilities revert to CN and CP if no longer needed for passenger service? In the context of the termination of intercity passenger services, it is unimportant whether the value on disposal accrues to the public through VIA or through CN. It is clear that there would be a significant realizable value for VIA's stations. The Ottawa station and associated tracks, for example, occupy a large tract of land served by major urban transport links which could provide a substantial development site. Similarly, the Halifax station is located on the edge of an area which has seen significant redevelopment during the past decade.

On balance, a disposal value of $100 million for stations is not unreasonable.

## 10.11 DISPOSAL OF MAINTENANCE FACILITIES

VIA has a nationwide network of maintenance facilities which were opened during the mid to late 1980s with an original cost in excess of $200 million. The largest facilities are in Toronto and Montreal with smaller facilities in Halifax, Winnipeg and Vancouver. VIA owns the land occupied by some of these facilities. In Toronto and Montreal, the land appears to be leased from CN.

The buildings and machinery all have value in reuse. GO Transit might be a potential buyer for the Toronto facility. GO is expanding its network, increasing its maintenance requirements and reportedly starting to outgrow its present maintenance facility near the VIA facility. As a first approximation, it is assumed that the proceeds from disposition might be on the order of $75 million, about one third of the original investment.

## 10.12 DISPOSAL OF OTHER ASSETS

The termination of VIA would release a wide range of low-valued assets such as office equipment and so on. For the whole system, these might be sold en masse to a company specializing in such disposal for anywhere between 5 and 10 million dollars.

## 10.13 RELEASE OF CN AND CP ASSETS

With the termination of VIA, there are a number of assets, which are solely related to passenger rail, which CN and CP would no longer require. The realizable value on such assets might be substantial.

Typical of these assets would be tracks leading from the mainline to individual stations, some sidings and passing tracks, and some stations. For example, the Edmonton passenger station is located downtown and requires a loop track from the CN mainline to the downtown. CN has indicated this track is not required for its freight system.

In theory, there should be no gain to the railways if these assets have been properly priced in the setting of charges for VIA. The railway would be no better off by selling the assets than it was by charging VIA for the use of the assets. In practice, it is unlikely that the two values would be equal. For one thing, there are significant differences between market land values and the land values the railways are allowed to use for costing purposes.[81] No estimate has been made of this value.

In addition to passenger-only assets, CN and CP may have some lines which carry passenger and freight traffic but which could be abandoned if there were no passenger trains. While there are a number of examples from the past where CN and CP have not been allowed to abandon a line due to the presence of passenger traffic, the 1987 legislation changed the situation so that VIA is required to either buy such lines or to pay the "full" cost to use them. This study has not identified any such lines.

It is clear that in the absence of intercity passenger trains, CN — and to a lesser extent CP — will have more infrastructure and other assets than might otherwise be justified by the present and future freight transportation requirements and it may take some time to adjust this level of plant investment.

## 10.14 OTHER POTENTIAL COST IMPACTS

There are three other direct impacts that might be reasonably considered as part of the costs and savings in the termination of the intercity passenger network.

### Provision of Alternative Transportation in Remote Areas

Some of the present VIA routes have been identified as serving remote areas where there is no reasonable alternative. There are a variety of alternatives for serving those areas which are truly remote, with cost estimates ranging from as low as $50 million to as high as $250 million.

### Changes in the Costs of GO Transit and MUCTC

In Montreal and Toronto, suburban rail transit systems use some of the same track, stations and other facilities as VIA. If these are not shared with VIA, some change in the cost structure for the transit systems can be expected.

### Changes in the Net Costs of CN and CP

As with the urban transit systems, some of the operating costs of providing rail freight service are based on sharing track with passenger trains. To the extent that the actual avoidable costs differ from the charges to VIA, there may be some impact on CN and CP's net operating costs. Even if VIA were paying the true long-run costs, it might take some time for all of the long-run adjustments to be made. As an indicator of the magnitude of any such impact, payments to CN and CP for services provided to VIA totalled $129 million in 1989, roughly 2 percent of the total domestic revenues of the two companies.

## ENDNOTES

1. Trains can carry 1,000 passengers or more. For a "state-of-the-art" passenger system, François Lacote, the Director of Mechanical Engineering of the French National Railways (SNCF) states that the "Northern high speed line . . . will allow for a traffic potential of 22,000 passengers per hour in each direction. . . . This in fact corresponds to the potential of a 14-lane expressway." *TGV System Developments*, March 1992, p. 52. This implies 40 trains per hour each way (which seems very high for the speeds that the SNCF contemplates for this line).

2. As of April 1992, the fastest revenue service is at 300 kilometres per hour. The "Chunnel" line is being designed for 320 km/h; possible future "extension" to 350 km/h has been discussed. The TGV has set a world speed record of 515 km/h.

3. In addition to this amount for the corporation, the railways were paid $70 million for passenger rolling stock in 1978, and a further $47 million for rolling stock and infrastructure in 1979.

4. In the mid-1980s VIA received significant interest income due to the differences in timing between receipt of government payments and actual expenditures. This situation has been changed and, in any event, does not represent true "earnings" for the passenger rail system.

5. To the extent that such costs are really "one-time" costs, they might properly be identified separately as part of the start-up costs of VIA, and be considered as much part of the investment as the purchase of stations, maintenance facilities and rolling stock. Doubtless, there is a significant ongoing component.

6. These services are essentially routes served. However, there may be overlaps. As an example, Toronto–Kingston passengers may be accommodated on the Toronto–Montreal and Toronto–Ottawa services, as well as on the (now cancelled) Toronto–Kingston service.

7. In its cost recovery reports and other documents, VIA makes a distinction between "avoidable" costs and "common system costs" (referred to as simply "common" or "system" costs or as "excluded" costs). These categories should not be interpreted as equivalent to "variable" and "fixed" costs. While nearly all of VIA's "avoidable" costs are "variable," not all of the "common system costs" are "fixed" given the general accepted usage of the term in railway costing. Nor are all the "common system costs" overhead costs in the generally accepted usage of the term.

   VIA's distinction between "avoidable" and "system" costs stems from the traceability of costs to specific train services. In very general terms, any cost — short-run variable, long-run variable or "fixed" — which can be attributed to a single service is classified as an "avoidable" cost. Costs which cannot be directly traced to specific services are classified as "excluded" costs.

8. The Prince Rupert train was designated as a mandatory service providing remote access in October 1989.

9. For example, a weekly train used to be operated between Quebec City and Chambord, to serve 28 stations in the 225-kilometre remote area between Hervey and Chambord. The Montreal–Jonquière (Chicoutimi) train now serves these points and has, as a remote service, been designated mandatory. One could question whether provision of rail service to the sparsely populated remote segment of this train run was the reason or the excuse for retention of the Montreal–Jonquière full service train that also provides convenient service to cottages, clubs and lodges.

10. The rail passenger subsidy is less than 1 percent of the BCR's consolidated revenues.

11. This service was offered jointly with VIA, with the Toronto–North Bay portion included in VIA's results. Thus there may be some overlap in total passengers handled. With VIA's 1990 cancellation of its part of the Toronto–Cochrane service, the ONR has restructured its services providing one daytime train six days per week between Toronto and Cochrane with bus connections to Timmins.

12. Approximately $2 million of this money comes from the federal government as a section 270 payment. The ONR is not eligible for federal subsidies. The Toronto–North Bay part of the route, however, is legally operated by CN and thus qualifies for payments. Federal monies received by the ONR have generally been treated as a credit by the province against its subsidy obligations to the ONR.

13. This is the latest year for which fully compatible data were available.

14. The costing base for each railway is slightly different. For VIA, the operating subsidy includes the full cost of VIA with the exception of an allowance for the cost of capital on assets owned by VIA. For the ACR, the subsidy is only 80 percent of the loss, with the costing base being long-run variable costs — somewhat less than full costs of some functions, but including depreciation and cost of capital on all assets. For the BCR, the subsidy is based on the "full costs of operating the passenger services," but not of the extent of using fully allocated costs or including a capital charge for passenger equipment (which is separately funded). For the ONR, a full subsidy is paid based on fully allocated costs, including the cost of capital and depreciation. The subsidy for the QNS&L is the same as for the ACR; namely 80 percent of the loss, based on long-run variable costs.

15. The service groups used here are NOT the same as those used by VIA. Most importantly, the Ontario–Quebec services, grouped by VIA into a category called "*corridor*" are separated.

16. Some aspects of all remote services are homogenous, but there can be significant differences.

17. The 1990 VIA cost data, on which the analysis is based, exclude any extraordinary expenditures related to the downsizing of VIA.

18. This study does not so much project that ridership will reach two million in a few years' time, as assume a level of ridership that is reasonable given past and present trends in the market.

19. An additional frequency may not be physically necessary to handle the ridership increase, but would be required as a service improvement to attract the projected ridership.

20. Note that the typical passenger trip is significantly less than the route distance. Thus, the train services may be long distance, but the market is a blend of short to medium-distance trips plus some true transcontinental travel.

21. In some instances, crews cannot get a revenue-producing return trip but must be paid to return to their home base. In addition, crews qualify for "held away from home" allowances.

22. The above illustrates one of the issues with respect to operation of the passenger railway system as a separate entity (from the freight operation) with separate employees and facilities. Separate operation requires some minimum scale of activity to be effective. At some point, it may become less expensive to provide some of the operations as a marginal activity to the freight system. To return to the example of crews, there is sufficient freight traffic that the "deadheading" of passenger train crews might not be necessary if the

freight and passenger services drew from a crew pool. Would such savings be greater than the benefit of having dedicated passenger-train crews and fewer employees to train? Are three trains per week sufficient to justify a separate maintenance centre in Vancouver?

23. Revenues for the 1989 season were 20 percent higher than avoidable costs.

24. The Western Interprovincial services do "benefit" from tourism which provides a significant ridership base and contributes to the higher ticket prices. Tourism also provides much of the potential for ridership growth. However, tourist demand is very seasonal, and accommodating it leads to idle empty cars for much of the year.

25. On many services, passenger demand tends to be greater nearer the larger centre served by the regional train. Thus, the load factor somewhat understates the unused capacity available. A train may leave the origin with 15 percent occupancy and arrive with nearly 90 percent occupancy.

26. In this context, a network is defined as a group of services which operate into one or two common terminals using a common pool of equipment.

27. The estimates here do not include the higher-cost, lower-revenue overnight trains offered by VIA between Toronto and Montreal/Ottawa which were eliminated as part of the restructuring of VIA.

28. Peaks in demand affect most services in one way or another. As a general rule, the shorter the average passenger origin-destination travel time, the higher the peaking.

29. At a distance of 200 kilometres, and with a direct and uncongested freeway, bus and car have a relative (to Toronto–Montreal and Toronto–Ottawa) advantage. The relatively poor and slow Ottawa–Montreal track also has an effect.

30. Since the Montreal–Ottawa service is fully integrated in terms of equipment and the use of both the Montreal and Ottawa facilities, not all its fully allocated costs are truly avoidable. Removal of this service would result in a slight decrease in the cost-efficiency of the Montreal–Toronto and Ottawa–Toronto services.

31. An increase in the load factor might be possible. This would not, however, significantly alter the conclusions with respect to the low cost recovery of this service network.

32. Trains tend to be much fuller than a 55 percent load factor would imply between Toronto and London and somewhat emptier between, say, London and Windsor or Sarnia.

33. In some ways, services in southwestern Ontario are very similar to those of a regional network as described above, but on a larger scale. In addition, it is difficult to separate true intercity services or regional services from the provision of a wide-area Toronto commuter service.

34. For example, the SNCF receives specific, separate government funding for some activities. This is treated as earned revenue. In VIA's case, all government funding appears as deficit.

35. Note that four separate cost ratios are used in the table. The first is defined as total revenues divided by total expenses, including depreciation. The second (quoted from Amtrak's annual report) excludes depreciation and amortization from expenses. This ratio is not referred to in the present paper. The final two ratios exclude revenues earned from sources other than intercity passenger transportation. They are referred to as the *STAC* and the *LTAC* ratios.

36. In comparing Amtrak's results with figures for VIA, there are important definitional differences:

   - Short-term avoidable costs (as used by Amtrak) (STAC) are defined as "costs of activities that would stop [immediately] with the discontinuance of a route or train, or begin with the introduction of a new route or train." STAC include crews, fuel and power, and maintenance of way. In 1989, based on the ratios reported in the annual report, STAC accounted for 55 percent of expenses.
   - Long-term avoidable costs (as used by Amtrak) (LTAC) are defined as "all short-term avoidable costs, plus claims expenses, heavy maintenance and a portion of corporate and field overhead." In 1989, based on the ratios reported in the annual report, LTAC accounted for 72 percent of expenses.
   - Total cost (applied here to VIA) is defined as the full cost of operating the service, including an allocation of overhead and shared facilities plus an allowance for the opportunity cost of the capital invested in fungible assets.

37. Approximately 30 percent of the then existing rail passenger routes were included in the Amtrak network when it was created. On April 30, 1971 there were 547 intercity passenger trains operating in the United States. The next day, when Amtrak began, there were 243. By way of contrast, nearly every CN and CP passenger service became part of VIA when it was created as a separate entity.

38. *Federal Subsidies for Rail Passenger Service: An Assessment of Amtrak* (Washington, D.C.: Congress of the United States, Congressional Budget Office, July 1982).

39. The passenger services that were abandoned are costs that would disappear over a fairly short period of time (generally less than a year).

40. Included are proportions computed to be variable, over the longer term (several years as the system adjusted to abandonment of the passenger service), of property taxes, depreciation, cost of capital and administration.

41. Under this system, the state authority is expected to contribute 45 percent of the short-run loss in the first year of operation of a service and 65 percent of the long-term loss in future years, plus half of any new capital expenditures required for a service.

42. It was not possible to identify the extent to which the costs related to earning this $360 million reduce this effective cross subsidy. However, it is believed that these revenues make a significant contribution to overheads and profits.

43. VIA is now starting to earn a small amount of revenue from its equipment maintenance facilities.

44. This estimate does not make allowance for any capital requirements.

45. In 1989, the total avoidable costs of all of VIA's services accounted for 58 percent of total operating expenses (including depreciation). The total of all service LTACs accounted for 51 percent of Amtrak's total expenses. The inclusion of any avoidable costs of operating non-intercity passenger services would bring the Amtrak percentage closer to VIA's. There are no significant differences between the two railways in terms of what elements of cost are included in "avoidable." It should also be noted that some of Amtrak's cost advantage over VIA is the result of capital expenditures for which Amtrak is not required to account.

46. A service that carries passengers to/from several small centres destined from/to a large city is doomed to low average load factors as it empties progressively to the end of the line.

47. There is also cumulative 6 percent preferred stock, held by the Secretary of Transportation and issued in return for federal operating subsidies and capital contributions.

48. Essentially, the railroads were offered a choice of joining Amtrak and subscribing capital — in the form of assets or cash in proportion to their passenger train losses — and being relieved of their passenger train obligations, or having to wait five years before even applying to discontinue passenger trains. All major railways, except the Southern, the Rock Island and the Rio Grande, chose to join Amtrak.

49. The full page width headline read: "*Backward rail car has Transport Minister talking in all directions,*" (*The Citizen* [Ottawa], September 24, 1991). The Hon. Jean Corbeil was being taken to task for the position of the dome car on the Jasper to Prince Rupert train, and although there was an undertone of humour in the article, the publicity for the Minister was negative. From the perspective of VIA's viability, there is a danger that Amtrak (answering periodically and only directly to the legislature) does not face. The Minister or one of his advisors might be tempted to instruct VIA to "turn the car." This would cause the deficit of a service, justified on the basis of the access it gives to a few small communities without road access, to increase beyond the 1990 level of $11 million (a 91 percent subsidy). A cost-conscious management, on the other hand, would be more likely to remove the dome and reduce the deficit.

50. Of course, losses (in the face of an impossible mandate) of those among its key professionals with attractive alternative employment prospects have been widely attributed as a contributor to VIA's difficulties.

51. It is noted that the *Rocky Mountaineer,* VIA's venture that achieved commercial viability, was sold in 1989, and that such action does not constitute an incentive for VIA management to focus on this objective.

52. Although this locomotive was originally envisaged as light and rapid (comfortable does not really apply to a locomotive), as design progressed to prototype development, a very heavy machine emerged. Also, with its weight it lost the ability to go fast, and with a high unsprung mass on its axles, track damage considerations limited the LRC to speeds below 145 kilometres per hour, even on track of the highest standard. The LRC locomotive was a design failure, obvious even before prototype testing; normally such development projects would have been terminated before production. The LRC car has not been without problems as well, notably the banking system and, more recently, the axles.

53. It is worth noting that Amtrak's impressive cost recovery figures do not reflect the full extent of the significant capital expenditures required to bring about its resurgence.

54. In terms of VIA's definition of avoidable costs but not necessarily in terms of total costs.

55. In the case of Sudbury–White River, one might have expected an increase due to the cutbacks since *The Canadian* no longer served this route. Ridership survey results suggest that the change in schedule which makes return trips more difficult has resulted in a decline in ridership.

56. In the case of the one service where survey data were available, it appeared that less than 5 percent of the passengers made use of this type of fare. Most paid full fare, even for return trips.

57. All passenger survey data are based on a series of two one-week samples undertaken by Transport Canada in the summer of 1990. It is not known how representative these data may be of annual demand patterns.

58. An inspection of 1985-vintage Quebec highway maps indicates that, in addition to Parent, another third of the permanent population of the remote area is located on numbered bush roads.

59. The data contained significant numbers of trips with an unknown origin and destination, which may or may not involve the remote segment; thus the range.

60. This component included a number of school groups. In addition, the survey was carried out in 1988 and may be more reflective of past rather than current ridership.

61. This figure includes 1,615 residents of the Split Lake native community on the Thompson–Gillam road. It is not clear if the Fox Lake, the Valley River and the War Lake communities (total population 1,168) are included in the summary population estimates. Parts of these communities are along the line between Pikwitonei and Gillam.

62. These results may be a direct result of using a two-week sample of ridership.

63. At least four of the points thought to be remote appear to be accessible by some type of road.

64. The passenger demand survey for July 1990 confirms this.

65. Data for other years suggest that the traffic was seasonally concentrated between Winnipeg and the cottage area west of Sioux Lookout.

66. *The Sudbury Star*, June 2, 1992.

67. Obligations to provide remote transportation may be further blurred by residual common carrier obligations. Cottages may have been established in remote areas in good faith at a time when rail transportation was offered as a profitable business.

68. Change in NTA safety regulations and labour agreements might be necessary to carry passengers in a caboose.

69. This recently occurred with the Lynn Lake service. Freight demand dropped such that it was no longer necessary for CN to operate three regular freight trains. Thus VIA has been charged with the total train operating costs of at least one of the three trains each week.

70. Average of upper and lower berths.

71. The advantage of the railway diesel car (RDC) or other self-propelled equipment in low passenger density areas is that there are less crew, fuel and maintenance requirements. The cost of operating two RDCs (which are in good condition) is generally less than operating two passenger cars plus a locomotive. The RDC is also more flexible. On some routes, CN has had some trouble operating RDCs in winter conditions. RDCs have, however, been successfully operated in northern areas in Canada. At the present time, the British Columbia Railway operates a fleet of rebuilt RDCs between Vancouver and Prince George. VIA owns 60 or more operational RDCs which are not now used. Rebuilding would be required to operate in any of the remote areas and would entail $2 million to $2.5 million per unit. There is, however, both VIA's and the British Columbia Railway's rebuilding experience to draw upon.

72. This analysis assumes that CN is allowed to abandon the Cochrane–LaSarre portion of the line, or at least get out of any freight obligations and charge the passenger service the full cost of owning, operating and maintaining the affected part of the line.

73. The same-day return would require a substantial change in the time at which trains depart from and return to the Garneau Yard. It might be argued that any additional complication in the non-remote, non-rail part of the trip should be weighed against the operating subsidy savings.

74. A concept of payments or credits for not polluting or for polluting less is not practical; rather it is logical to charge polluters proportionally for the societal damage they cause. In the unimodal context of the present paper, it is really higher charges to the competing air and car modes that are represented as credits. Among the present VIA services, it is to the Toronto–Montreal and perhaps to some southwest Ontario operations that positive net externalities credits are the most likely to apply.

75. On much of CP's line to Saint John, the *Atlantic* often is one out of two or three daily trains (freight plus passenger) operated in each direction. The NTA ordered CN to abandon the easternmost 90 kilometres of the Gaspé line in February of 1992. This order has been rescinded by the Governor in Council, possibly in response to the Commission's interim recommendation to freeze branch-line abandonment.

76. The current agreements themselves have not been reviewed for this analysis. There are obviously a number of different levels of employment security benefits depending on the position and the length of service. For example, a 1986 Employment Security Supplemental Agreement between VIA and the Brotherhood of Railway Transport and General Workers, calls for VIA to make payments to employees laid off due to technological or organizational change, such that the worker's earnings — after receipt of unemployment insurance payments — are 80 percent of his average pre-layoff earnings. For workers with 30 or more years' service, such employment security payments would continue for up to five years. Should such an employee elect to resign, the one-time severance pay would not exceed one and a half years' pay. The present agreements, which provide for the augmented job security for employees with eight or more years' service date from the middle of 1989.

77. CP also transferred employees to VIA, but fewer than CN. CP's train crews were never transferred.

78. It is interesting to note that CN is already in the process of downsizing its work force. In 1990, for example, it reported that it had hired no new employees of any description in Atlantic Canada.

79. Using CN as the agency to terminate VIA is not unreasonable. CN, through its subsidiary Canac, acted as VIA's agent in the disposition of equipment made surplus from the 1990 service cuts. CN also has an organization in place for the disposal of land and other railway assets.

80. Quebec City owns a significant share as well.

81. CN and CP might benefit from the sale of surplus land since the Costing Regulations generally do not allow land to be priced at market rates when setting charges for VIA.

# APPENDIX A: NOTES TO VIA ROUTE-SPECIFIC DATA

Financial and operational data were derived from the *Cost Recovery Report* prepared by VIA's Finance Department, June 1991. Distance and frequency data were developed from the VIA Timetable, October 1989. Service group definitions follow those of VIA.

Train frequencies quoted are for a typical day and do not reflect weekend schedule adjustments.

An asterisk (*) after frequency indicates that additional frequency on all or most of this route is provided by other train services.

*Revenue per passenger-kilometre* excludes all revenues incidental to the transportation activity, including non-transportation tour and station revenues that could attribute to specific services.

All data have been converted from imperial to metric units.

## NOTES TO SPECIFIC LINE ENTRIES

1. Distance shown through Brantford. Some trains run via Stratford, 9.6 kilometres longer.
2. One train per day becomes the Amtrak train through to Chicago.
3. One train per day becomes the Amtrak train through to New York.
4. With the exception of peak periods, the *Ocean* and the Gaspé train operate as a single train between Montreal and Matapedia.
5. Distance shown for Montreal–Vancouver. The Toronto distance is 280 kilometres shorter, but adds 280 route-kilometres.
6. The Prince Rupert train is generally operated jointly with the Winnipeg–Vancouver train to Jasper.
7. Operated as a mixed train with an overnight layover at Gillam.
8. Some days operated as a passenger train and other days operated as a mixed train.
9. The Toronto–North Bay–Cochrane–Kapuskasing service operated jointly with the ONR as a through train. The data here exclude the North Bay–Cochrane segment. VIA operated a second Toronto–North Bay train on weekends using rented ONR equipment.
10. Does not include the Moncton–Charlottetown bus service.

# APPENDIX B: VIA'S OPERATING COST STRUCTURE

VIA's 1988 operating statistics, revenues and costs, and cost avoidability, according to VIA's procedure, are summarized as:

| | System total | Excluded dollars | Avoidable % | Avoidable dollars | Common content |
|---|---|---|---|---|---|
| **Operating data (millions)** | | | | | |
| Passengers | 6.4 | | | | |
| Passenger–km | 2,285.3 | | | | |
| Seat–km | 4,360.5 | | | | |
| Train–km | 20.0 | | | | |
| Car–km | 115.2 | | | | |
| Motive power–km | 20.3 | | | | |
| **Revenue ($ million)** | | | | | |
| Transportation | 185.3 | 0.0 | 100 | 185.31 | |
| On–board services (OBS) | 16.6 | 0.0 | 100 | 16.59 | |
| Other | 1.0 | 0.0 | 100 | 1.04 | |
| Tour | 13.2 | 0.0 | 100 | 13.19 | |
| Sales tax | (1.2) | 0.0 | 100 | (1.22) | |
| Station | 0.9 | 0.3 | 43 | 0.58 | |
| **Total** | **215.8** | **0.3** | **99** | **215.49** | |
| Non service | 2.3 | 2.3 | 0 | | |
| **Costs ($ million)** | | | | | |
| Transport overhead | 3.4 [ 0%] | 3.4 | 98 | | Low |
| Linehaul | 40.0 [ 5%] | | | 40.0 | |
| Rentals | 2.3 [ 0%] | | | 2.3 | |
| Crew | 79.8 [ 11%] | | | 79.8 | |
| Fuel | 35.4 [ 5%] | | | 35.4 | |
| Equipment Mtc | 217.4 [ 29%] | 89.4 | 59 | 128.0 | High |
| Switching | 7.9 [ 1%] | 4.7 | 40 | 3.2 | High |
| Bus/taxi | 0.8 [ 0%] | | 100 | 0.8 | |
| Other CN/CP | 14.5 [ 2%] | 11.8 | 11 | 2.7 | Unknown |
| Provisions | 5.6 [ 1%] | 0.6 | 89 | 5.0 | |
| Incentives | 9.2 [ 1%] | | 100 | 9.2 | |
| On–train OBS | 82.1 [ 11%] | 11.7 | 86 | 70.4 | Low-med. |
| Off–train OBS | 58.7 [ 8%] | 33.0 | 44 | 25.7 | High |
| Marketing/sales | 43.6 [ 6%] | 22.5 | 48 | 21.1 | Unknown |
| Station property | 26.5 [ 4%] | 22.1 | 17 | 4.4 | Very high |
| Administration | 63.1 [ 8%] | 63.1 | 0 | | Very low |
| Corporate expenses | 4.8 [ 1%] | 4.8 | 0 | | Very low |
| Ownership | 55.6 [ 7%] | 55.6 | 0 | | Very high |
| **Total** | **750.7 [100%]** | **322.7** | **57** | **428.0** | |
| Extraordinary item | 40.0 | 40.0 | | | |

**Note:** **The extraordinary item (not VIA's wording) is $40 million in what is considered to be catch-up maintenance expenses on old equipment. The 1990 cost structure is similar and is reflected in the cost model.**

# APPENDIX C: COST ELEMENT ALLOCATION RATIONALE

For purposes of the present analysis, the individual cost accounts were allocated on the basis of the following considerations.

## TRANSPORTATION

This cost category includes mainly transportation supervision and functional overheads. There is little (if any) direct, but unallocated, cost. The transportation overheads represent about two percent on direct transportation (fuel, linehaul and crew) costs. There are a variety of explanatory variables for this expense. In this analysis, one quarter is attributed to *train-kilometres* (to capture work performed), one quarter is attributed to *direct transportation expenses*, and one half to *route-kilometres* (to capture the higher costs per passenger of operation of low-density services). This attribution methodology also reflects the fact that much of the transportation function will not change in step with direct expenses.[1]

## LINEHAUL

This is the payment made by VIA for use of the track to CN and CP and accounts for approximately 5 percent of the total costs. Linehaul is priced (by CN and CP) using a combination of *train-kilometres* and *gross-tonne-kilometre* values. In the event that VIA must operate its own lines, there would be a substantial increase in this cost.

## RENTALS

This represents payments by VIA for use of equipment other than its own. For most services there are no rental costs. Much of the rental expense is incurred on the Toronto–North Bay–Kapuskasing (now discontinued), the Toronto–Niagara Falls and the Toronto–Sarnia services where the VIA train is operated in conjunction with that of either the ONR or Amtrak respectively. There are also significant rental expenses in northern Manitoba where more extensive use of CN equipment is made. For the most part, rentals are so small that this cost item can be safely ignored.

## CREW

Crew costs represent approximately 10 percent of VIA's total costs. The majority of crew costs are incurred directly by VIA. Only crews operating on long sections of CP track and those in northern Manitoba are supplied by the freight railways. It is reasonable to expect crew costs to decrease in a long-term, steady-state operation. To date, VIA has reached agreement with the Brotherhood of Locomotive Engineers (BLE) to eliminate the second engine crew member on most locomotive-hauled trains and agreement with the United Transportation Union (UTU) to reduce the number of train crew on many routes. Both of these agreements will take some time to fully implement since the reductions will take place mainly through attrition. Other potential areas of savings include the basis of pay and the length of crew runs. The fact that VIA has reached crew reduction agreements with its labour force, lends credence to its ability to reduce crew costs in other ways. For this analysis, savings of 10 percent[2] to 40 percent have been assumed, depending on the type of service.

## FUEL

Fuel accounts for only four percent of VIA's 1988 costs. Modest improvements can be expected as the system moves to the use of modern locomotives and rolling stock. It is of interest to note that the effective price paid for fuel has increased by 19 percent in 1990.

## EQUIPMENT MAINTENANCE

The maintenance of cars and locomotives — including cleaning and inspection as well as pure preventive maintenance and repair — accounted for $257 million in 1988. This is one third of VIA's total reported costs. VIA attributes approximately half of its equipment maintenance costs to services. The other half is split between the costs of operating the maintenance centres, a functional overhead, and major equipment maintenance and repair. The 1988 cost data included an inordinate amount of catch-up maintenance. Thus the basis of costing has been reduced by $40 million. The excluded costs in the maintenance category have been treated as overheads (approximately 50 percent) to the direct maintenance costs on a system basis. In addition to the catch-up expenditures, the level of maintenance costs is also governed by the fact that much of the equipment is old and inefficient, and there are many inefficiencies in the maintenance process. As an approximation, a 20 percent average reduction in maintenance costs has been assumed to be reasonable for a steady-state railway system which is equipped with modern equipment.[3]

## SWITCHING

VIA's switching requirements are a minor part of the overall cost and are predicted to decrease substantially with changes in maintenance centres and other practices. As a simple expedient, estimates of direct switching costs have been increased to account for the switching that VIA considers to be excluded.

## ON-BOARD CUSTOMER SERVICES (OBS)

On-board services account for about 11 percent of total costs. Most of these costs can be attributed directly to specific train requirements. The *excluded* component of this category consists mainly of provisioning and support personnel and can be treated as a functional overhead (16 percent in 1988, 6.2 percent in 1990[4]) to the direct costs. The OBS overheads are heavily weighted to corridor services due to the costs of the employee service centres in Toronto and Montreal. For this reason, direct OBS expenses for corridor trains are given a double weight in the calculation of the overhead.

## OFF-TRAIN CUSTOMER SERVICES

Well over half of the customer services expenses (station employees and passenger handling) is treated as *excluded* by VIA. Much of this exclusion represents facilities shared by a number of services rather than functional overheads. The true customer services costs vary significantly by route and there could be significant economies of density (major terminal stations versus minor line stations). Non-administrative costs of shared stations have been apportioned to the service groups in an approximate manner, based partially on 1988 data. Reservation system costs have been related to both passengers carried and passenger-kilometres.

## MARKETING AND SALES

Avoidable marketing and sales expenses include three elements: tour expenses (approximately $8 million in 1988), advertising and promotion aimed at a specific service (low in 1988) and credit card discounts/agency commissions on tickets. Since there were no tour expenses or specific advertising expenses incurred in 1990, it has been possible to determine an aggregate credit card discount/agency commission rate as a percentage of revenue. These range from 2 to 7 percent depending on the service type.

## STATION PROPERTY

Station property expenses are limited to the non-capital[5] costs of operating stations. Very little of the excluded portion of station property is considered to be a functional overhead. For the most part, the excluded costs are attributable to maintaining stations which are shared by a number of services. In the analysis, the costs — net of concession and other revenues — for each station or series of stations on a specific line segment were assigned directly to the service group involved. This process left a few terminal stations for which the costs (about 20 percent of the total) had to be allocated between service groups on the basis of passengers handled. The station data indicate that station property costs are relatively insensitive to variations in passenger demand. As a result, it is assumed that only 5 percent of station costs vary with changes in demand.

## ADMINISTRATION

In 1988, VIA reported administration costs to be $63 million. These are mainly administrative rather than functional overheads[6] or shared direct costs and include functions such as finance, human resources, data processing and legal services. Most of these costs are incurred at headquarters rather than at the regional level. Administrative expenses, including corporate expenses below, have been treated as an overhead to all other non-capital railway costs. Given VIA's 1988 results, the overhead is approximately 11 percent. Following the 1990 network restructuring, this overhead appears to have increased to 14 percent. There are three issues with respect to administrative overheads: *What is the appropriate level of overheads?*[7] *Do some types of services require more administration than is implied by treating this cost as an overhead? How do administrative requirements change as direct costs change?*

On the first issue, it is worth noting that VIA's administrative component has ranged from 9 to 11 percent on direct costs for the past 10 years. The data suggest no particular pattern or relationship. What is clear is that the recent increase (most of which actually appears in the 1989 financial results) is related to the network restructuring and downsizing of VIA. Part of the increase is a natural result of decreasing the direct cost base over which administrative overheads are allocated. Some is related to the actual work of restructuring.[8] It can also be assumed that changes required to downsize some of the administrative costs will lag behind changes in fuel, crew and other expenditures. Barring any evidence to the contrary, it is assumed that a steady-state level of administrative expense would be equivalent to 11 percent (the average of the 1988 and the 1990 experience) for the 1990 cost and operations base.[9]

There is little evidence upon which to base analysis of the second issue. It can be argued that the segments such as the remote services may attract more administrative costs than the M–O–T corridor. On the other hand, it is also clear that the corridor attracts more attention (and expense) in terms of looking at service improvements and other administrative activity. Pending other evidence to the contrary, no attempt has been made to apply different administrative overhead rates to different services,

Again, there is little evidence upon which to base an analysis of the third issue. It can be expected that, as the intensity (as opposed to the scope) of activities increases, administrative costs should not increase as fast as direct costs. On the other hand, it can be expected that efficiency gains in transportation and customer service activity might not result in similar gains in certain types of administration. The approach taken in this analysis is to assume that administrative costs vary in proportion to other costs. Thus, there may be some understatement of administrative expenses for the presently "downsized" VIA operation, but the analysis should reasonably reflect the steady-state assumption where VIA is no longer in the middle of a crash program of rebuilding its fleet, building maintenance facilities, transferring employees from CN, upgrading stations and so on.

## CORPORATE EXPENSES

Corporate expenses (including the senior executive function) have been included in administration and increase the administrative overhead by approximately one percentage point for the 1988 data.

## OWNERSHIP

These are VIA's depreciation expenses. None of these expenses have been attributed to services. VIA reported the following gross investments:

| | $ million |
|---|---|
| Land | 2 |
| Rolling stock | 541 |
| Stations | 13 |
| Maintenance buildings | 165 |
| Machinery | 13 |
| Office furniture | 24 |
| Leasehold improvements | 139 |
| Other | 53 |

In the costing, capital assets have been included on the basis of annual depreciation plus 10 percent real cost of capital on the net book value, assuming that the assets are 50 percent depreciated.

Rather than using VIA's present rolling stock asset base, new equipment has been assumed to have been purchased at current prices. Maintenance buildings and machinery[10] have been treated as an overhead on maintenance activities. Office furniture has been treated in the same way as administrative expenses.

A capital charge for stations, leasehold improvements and other has not been included in the analysis since there is not yet a breakdown of these assets. In aggregate these could account for some $15 million per year. The asset base is a mix of small expenditures on many stations with significant expenditures on specific assets. For example, the Gare du Palais upgrading is reported to have cost $30 million. Capital charges for this asset should only be attributed to the Montreal–Quebec City service. The Ottawa–Brockville track improvement reportedly cost $60 million. This would be attributable only to the Ottawa–Toronto service.

## ENDNOTES TO APPENDIX C

1. The train control centre, for example, should be independent of the level of crewing, fuel efficiency and the length of the trains.

2. There are a number of short-distance, self-propelled vehicle (SPV) runs where the potential for crew reductions and other improvements is limited.

3. It can be expected that repair experience would be better than 20 percent. The cleaning and routine inspection requirements, however, are not expected to decrease dramatically with the introduction of modern equipment.

4. This significant decrease appears to be due in part to a real reduction in the level of overheads incurred and in part to some functions being directly attributable to specific train services.

5. Except to the extent that capital costs may be included in the rental payments to CN and CP. This leaves some important issues unresolved; for example, the apparent price to VIA for use of the Toronto and Montreal stations appears low given the location of the real estate (if one presumes that the CN/VIA "divorce" was appropriately settled with these passenger assets going to CN). On the other hand, there are other stations — notably Winnipeg—with relatively high costs given the present levels of traffic.

6. Pensions, UIC, CPP/QPP and similar overhead expenses are accounted for in the direct functional and other costs, and are not included in administration.

7. This issue is the descriptive one of determining overheads applicable for long-run steady-state operation rather than the normative one of determining whether VIA spends too much on administration.

8. The direct costs of restructuring — severance pay and so on — have been netted out of VIA's financial data that are being used for this analysis.

9. This figure allows for netting out of approximately $6 million in non-service revenues earned by VIA.

10. In 1990, maintenance facility gross investment stood in excess of $215 million. Some of this is new capital, some is included in the land and leasehold improvements. In general, however, it appears that the asset base is lower than the reported expenditures on maintenance facilities.

# APPENDIX D: NOTES TO AMTRAK ROUTE-SPECIFIC DATA

Financial data were derived from the *Route Report* prepared by the Controller's Department, National Railroad Passenger Corporation, Washington, January 23, 1990. Train distance data were supplied by Intergovernmental Affairs, Amtrak. Distance, trip time and frequency data were developed from the Amtrak timetable, October 29, 1989. All service and service group definitions are those of Amtrak.

An asterisk (*) after frequency indicates that there is additional frequency on all or part of this route provided by other train services.

All data have been converted from U.S. measure to metric units.

## NOTES TO SPECIFIC LINE ENTRIES

1. Includes one train/day with an additional 166 kilometres to Santa Barbara.
2. Operated only part of 1989.
3. One train operates 2,577 kilometres between Chicago and Salt Lake City and then splits.
4. Operates via St. Louis. Distance and time are shown to Centralia only where train joins with Chicago–New Orleans. Does not seem to show second train Kansas City–St. Louis. Train kilometres appear correct for two Kansas City–St. Louis trains.
5. Time and distance are shown for New York to Chicago; the Boston section is 93 kilometres longer over 322 additional route-kilometres.
6. Actually a through train New York–Albany–Montreal; the New York–Albany portion is included in New York–Niagara Falls.
7. Train-kilometres appear to be missing two round-trips per day.
8. Timetable time and distance are shown to Miami. Both trains have Tampa sections. The total route is about 3,235 kilometres.
9. Duplicates route-kilometres of New York–Charleston–Florida service.
10. Significant duplication of New York–Florida route-kilometres.
11. All but 172 route-kilometres duplicated by NEC or Florida trains. Data may include daily train, New York to Richmond.
12. Train splits at Spokane, Washington; allow additional 608 kilometres for Portland connection.
13. Time and distance are shown to Houston. Train splits in Dallas with section destined for San Antonio to connect with New Orleans–Los Angeles train. This adds 509 route-kilometres.
14. Includes approximately 45 trains per week New York–Albany/Schenectady, seven of which go on to Montreal, plus 17 trains per week to Niagara Falls, seven of which go on to Toronto.
15. This service was reinstated during 1989. This may account for the low recovery ratio.

# APPENDIX E: CANADIAN VIEWS ON RAIL TRANSPORTATION*

The Commission's public hearings process enabled a broad range of Canadians to present their views on the national rail network. Of the verbal submissions, about 20 percent dealt primarily with rail transportation, with many more raising the subject in the context of the transportation system in general. On the "dial-a-brief" line, 108 out of the 128 submissions received were on the subject of rail transportation. In terms of numbers of submissions received, rail transportation appears to be at the top of the nation's transportation agenda.

Submissions were received from all parts of Canada, and from groups representing a broad cross section of Canadian society. In general, we can say that the Commission heard representative views from:

- railway companies;
- high speed rail interest groups;
- rail unions and rail pensioners;
- rail support groups;
- environmental groups;
- the tourism sector;
- provincial and municipal governments; and
- the general public (including most "dial-a-briefs").

Common threads run through most of these submissions. The single most popular subject was VIA Rail. The majority of these submissions either condemned the 1990 service cuts, or offered suggestions for how to improve the operation of the company. Interventions in support of high-speed rail came a distant second, followed by submissions dealing with rail freight.

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* The first draft of this appendix was prepared by Royal Commission staff member Paul Monlezun.

## RAILWAY COMPANIES

Canadian National, Canadian Pacific, and VIA Rail all told the Commission that it would be unrealistic to separate passenger transportation from freight. They pointed out that the close relationship between passengers and freight, particularly in the rail mode, meant that studying passenger transportation alone would distort the picture too greatly.

All three companies said that the single most important question facing the Commission was how to make an adequate comparison between operating subsidies and transportation modes. CN and CP, in particular, were concerned about the relative competitive disadvantage their companies faced compared to the trucking industry. They felt that trucks were unfairly subsidized and that the federal government should levy user fees to cover the operational, maintenance and development costs of road infrastructure.

VIA Rail focussed on the cuts to scheduled services which came into effect on January 1, 1990. The company provided an overview of its recent history and suggested that many of the company's problems derived from a lack of political leadership. They felt that if the company had been allowed to modernize and keep pace with the demands of the marketplace, VIA would be in a better financial situation.

The railways also devoted significant portions of their presentations to high speed rail in the Quebec City–Windsor corridor. VIA Rail and CN, in particular, were highly enthusiastic about the possibilities. CP, while endorsing the concept of fast trains, doubted that high-speed rail would be financially viable if the government continued to subsidize competing modes indirectly by covering the costs of highways and airports.

CN and CP were both aware of the suggestions that the companies share one right-of-way in the corridor to allow the other one to be dedicated to passenger trains. Neither company seemed to be particularly enthusiastic about the idea; however the subsequent more private CP message to Commission staff was more positive.

## HIGH-SPEED RAIL INTEREST GROUPS

The Commission received submissions from both private-sector consortia who had expressed an interest in building a high-speed rail system in the Quebec City–Windsor corridor. Air Canada, in partnership with CP, has more recently announced its interest in the system. Both Asea Brown Boveri (ABB) and Bombardier, which holds the North American rights to the French TGV, made pitches for their particular technologies, but the two companies also pointed to the need for high-speed rail and the potential advantages of such a system.

Both companies argued that the Montreal–Toronto travel market was mature enough to support high-speed rail, they also felt that the project could boost the economies of both Ontario and Quebec. ABB believes that a high-speed train could be introduced with little or no direct public funding. Bombardier, on the other hand, told the Commission that a TGV train would require several billion dollars in government funds. Bombardier pointed out, however, that in the long run, the TGV could save Canada money through the reduction of both road and air congestion.

## RAIL UNIONS AND RAIL PENSIONERS

The primary interest of the railway unions, above all, was to protect and preserve the jobs of union members. The 10 transportation union groups that appeared before the Commission, and several others which sent written submissions alone, condemned the job cuts that accompanied the 1990 VIA Rail service reduction.

Labour almost uniformly stated that VIA Rail had been mismanaged since its creation. A number of union submissions even suggested that the government was deliberately allowing VIA Rail to fail so that they could justify shutting down the system altogether.

All the rail unions demanded that the government fully restore the recently cut VIA services. They also called on the government to give the railway a legislative mandate and the money to buy modern rail cars. When asked whether VIA Rail could be operated profitably if it were given a mandate and modern rolling stock, several intervenors were unable to answer.

Rail pensioner groups, like the unions, were adamant that the government should restore rail services. The four groups, however, seemed to be much more concerned with preserving "the railway culture" and maintaining historic rail lines than was organized labour. The CP Rail pensioners also pointed out that because most of the VIA services running on CP tracks had been cut, their free rail passes were no longer of any value.

## RAIL SUPPORT GROUPS

Rail support groups, notably Rural Dignity, the Western Rail Passenger Restoration Committee, the Save VIA Rail Committee, and several branches of Transport 2000 were enthusiastic boosters of passenger rail. They argued that rail transportation was the safest, most accessible and most "environmentally friendly" mode of transportation available to Canadians. They also highlighted VIA Rail's role in providing transportation to otherwise isolated communities.

These intervenors shared the conviction of the unions that the government was allowing VIA rail to fail so that it could justify dismantling the company. They also agreed that the federal government should spend millions of dollars on new rail cars and locomotives. In their submissions, Transport 2000 and the Western Rail Passenger Restoration Committee suggested that VIA Rail would be much better off if it were modelled after Amtrak, which operates passenger rail services in the United States.

## ENVIRONMENTAL GROUPS

Most of the environmental groups that appeared before the Commission singled out rail transportation as one of the cornerstones on which to build an "environmentally friendly" transportation system. These groups felt that Canada had become to depend on the car. In general, environmentalists wanted to see a modernized VIA Rail, better connections between train stations and transit systems, and stiff fuel taxes that would encourage travellers to switch to the train. Some groups also supported high-speed rail, but only after an exhaustive environmental review.

## THE TOURISM SECTOR

The Commission received several submissions from the tourism sector, including one from a group that was trying to start its own rail service. In general, the tourism industry was very concerned about the cancellation of VIA Rail services, especially the *Canadian*. They pointed out that rail travel packages were very popular with tourists, in particular the Japanese, and that the cancellation of the *Canadian* had a noticeable effect on travel bookings. The industry was pleased that the *Rocky Mountaineer* had been privatized, but they were concerned that Canadian Pacific might not allow the company to have adequate access to its tracks.

Sam Blyth and Company joined other intervenors in condemning the unco-operative attitude of the big railroads. Mr. Blyth was convinced that it would be possible to run a profitable luxury train service, but felt that the most difficult part would be convincing Canadian Pacific to allow his company to use its tracks. Blyth and Company was also concerned about VIA Rail's plans to launch its own luxury train service, which it said would be publicly subsidized and might "ruin the market" for luxury trains in Canada if it were operated improperly.

## PROVINCIAL AND MUNICIPAL GOVERNMENTS

At every one of its hearings, the Commission received submissions from representatives of the provincial and municipal levels of government. In general, the provinces attempted to look at rail within the context of the transportation system as a whole. Most provincial governments reminded the Commission that rail was an integral part of the transportation network and should not be overlooked. In the West and Atlantic Canada, the provinces called on the federal government to reinstate the cancelled VIA Rail services. Ontario, while supporting VIA Rail, was not as forceful as the other provinces.

At most stops, the Commission heard from municipalities that had been directly affected by the VIA Rail cuts. Some of these towns and cities, such as Moncton, Melville (Saskatchewan) and Calgary, saw the VIA cuts as major blows to their local economies. Many others complained that their citizens had lost a transportation option. Even some communities that had not been served by rail for many years called on the government to reinstate VIA services.

## THE GENERAL PUBLIC

Every single private intervenor that appeared before the Commission to talk about rail transportation supported VIA Rail. Private submissions, however, came in disproportionate numbers from Nova Scotia, Saskatchewan and Alberta, where public outrage over the VIA cuts was strongest. Public interventions contained all the same points that the VIA Rail support groups made, but they differed from them in a couple of key ways:

- Private intervenors seemed to have a greater attachment to the train than did other presenters, frequently stressing the train's role in building the country and in maintaining national unity.
- They did not directly address the question of subsidies and the cost of operating passenger rail services.

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# AIRPORT INVESTMENT AND PRICING POLICIES

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November 1991

## 1. INTRODUCTION

Planning and managing Canada's airports are two of Transport Canada's most important responsibilities. Airports owned by the federal government have a replacement value, excluding land, of over $10 billion. In the 1988-89 fiscal year, the Airports Authority Group of Transport Canada spent $247 million on capital investments for the expansion, restoration and upgrading of airport facilities. Pearson International Airport's Terminal 3, funded by the private sector, cost $550 million. The three proposed additional runways at Pearson would cost another $469 million. Investments of this magnitude require wise and informed decisions.

This study examines airport planning from an economic perspective, dealing primarily with policies regarding efficient allocation of resources at Canadian airports. One aspect of resource allocation is the use of existing capacity, examined in this study as the "pricing problem." The second aspect is the provision of additional capacity or building of new facilities, which is addressed as the "investment problem." In theory, these aspects are two sides of the same coin, but the distinction between them is important from a more practical policy perspective.

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The report starts with a background section on the evolution of Canadian airport planning, providing a brief institutional history, a review of the prevalent physical planning paradigm, and a discussion of the three main pillars of the federal government's current airport policy framework: devolution, cost recovery and environmental review. The third section of the report deals with the investment problem, first from a theoretical perspective, followed by two recent case studies (cost-benefit analysis of airside capacity expansion proposals for Toronto and Vancouver international airports). The fourth section deals with the pricing problem, providing a theoretical overview, followed by an assessment of alternative pricing policies and current practices. The conclusion of the report, recommends the incorporation of a continuous cost-benefit analysis framework into the airport planning process, to deal not only with pricing and investment policies but also to mitigate external impacts.

## 2. EVOLUTION OF CANADIAN AIRPORT PLANNING

To set the institutional and policy context within which Canadian airports are operated, the following section provides a brief institutional history. Then a more detailed examination of the airport planning process in Canada deals with the physical planning heritage of a system which has not helped to promote economic efficiency. Finally, a discussion of current policy includes the three principal aspects of federal airport policy: devolution, cost recovery and environmental review.

### 2.1 INSTITUTIONAL BACKGROUND

From the 1960s to the mid-1980s, airports were the responsibility of the Canadian Air Transportation Administration (CATA), which was part of Transport Canada. Airport investments were funded out of CATA's capital budget, which was determined in negotiations between it and the Treasury Board. Airports raised some revenues, primarily through landing fees and rentals of terminal space, but in only the largest airports did revenues cover operating and maintenance costs.

There was no requirement for airports to be self-financing, and they were not. Revenues went to the Consolidated Revenue Fund, and expenditures were paid out of the Fund, but the two were not linked. The costs of the

Air Navigation System, kept separate from those of the airports, were also funded out of the Consolidated Revenue Fund.

The dominant professional groups in CATA were people with hands-on aviation industry experience (for example, former pilots and controllers) and, on the planning and construction side, engineers. Their approach to planning was to set appropriate physical standards for the various facilities (runways, roads, terminals) that make up an airport system and, when these standards were exceeded, to add capacity. These groups did not think in terms of economic concepts, such as use of the price system to ration capacity, or the time value of money.

The demand for air travel grew very rapidly in the 1960s, for a number of reasons. The introduction of jet aircraft dramatically lowered the cost of air travel, and equally dramatically shortened travel times. Real income was increasing. Charter airlines came into being and, by achieving high load factors, were able to lower prices even more. The airport planners and managers in CATA were unprepared for this air travel boom and, by the mid-1960s, major Canadian airports were operating beyond their capacity, with passengers suffering through long queues, particularly in the terminals.

An airport system managed by a government department, accountable to Parliament through the Minister of Transport, must be responsive to the pressures of its stakeholders. In addition, the Department is influenced by the main priorities of government as enunciated by the central agencies. The congestion at major airports meant that airport users — airlines, passengers and general aviation — were complaining. This was an embarrassment to both the Minister and the public servants. On the other hand, with a strong economy, the government's tax revenues were growing and there was no deficit problem. Transport Canada made a strong case to the Treasury Board that it needed additional funding to add capacity to its congested airports. The funding was readily made available.

Because of the long lead time required to plan and build facilities and the even longer life of the facilities themselves, airport planning decisions are made under great uncertainty. It is difficult to predict demand in advance, and planners will either overestimate or underestimate. In this context, the bureaucratic and political costs of providing additional capacity too late are the continued criticism by the stakeholders (airlines, general aviation, the travelling public). The cost of providing additional capacity too soon is excess capacity for awhile, which does not bother stakeholders. As airports were financed by grants from the Consolidated Revenue Fund, rather than loans, the bureaucratic and political costs were negligible. Indeed, if it was thought that the Treasury Board's fiscal posture was more receptive in the present than it would be in the future, there was a bureaucratic incentive to hasten construction.

Major airports in Toronto and Montreal had a second issue to contend with — should extra capacity be added at the existing airports (Malton, as Pearson was then called, and Dorval) or should new airports be built. The virtue of new airports was that, with substantial space, they could be planned as real showcases, thereby avoiding the physical constraints of the existing sites. Although new airports were more costly than expanding existing sites, cost was not a major problem. In the case of Montreal, the second airport at Mirabel was seen as an economic development project for the Montreal region.

In Toronto, another factor came to the fore, the response of those living near Malton to the prospect of additional noise due to new runways. In 1968 Etobicoke residents put a great deal of pressure on Transport Canada not to expand Malton. For Transport Canada, the path of least resistance became the construction of a new airport. Thus ensued a four-year search for a site, ending when Pickering was chosen in 1972.[1]

In the mid-1970s and into the 1980s the government ministry approach to airport planning, as exemplified by the decisions to build second airports at Mirabel and Pickering, was crumbling. Though the federal government succeeded at building an airport at Mirabel, the proposed Pickering airport met with strong opposition from local residents, environmental groups and, ultimately, the Government of Ontario. Local residents did not want to lose their homes to a new airport. Environmental groups argued that a Pickering airport would destroy the last semi-rural area close to Toronto. They also criticized CATA's planning assumption that air travel demand would continue growing rapidly for the rest of the century. This assumption was consistent with CATA's view of the comparative risks of under-building and over-building. In addition, the Mirabel Airport was tremendously under-used, implying that Pickering might also be a white elephant. Finally, the two-airport system in Montreal inconvenienced connecting passengers, with the result that Montreal lost some connecting traffic to Toronto. When the Ontario government bowed to public pressure and refused to provide improved ground access to Pickering, the federal government decided, in September 1975, to delay the proposed Pickering airport indefinitely.

By the mid-1970s, the public sector context had changed. Rapid growth in government programs in the late 1960s and early 1970s, followed by slower economic growth in the mid-1970s meant that readily-available funding for CATA was drying up. The federal government was beginning to run deficits. Airports were now being looked upon as a source of revenue, and the first steps were being taken to move towards financial self-sufficiency. Airport fees were raised as part of the government's 1975 budget reduction package, and the air transportation tax was introduced in the late 1970s.

Even though CATA's capital funding was reduced, the demand for facilities was still growing because of the dramatic spurt in air travel caused by the deregulation of the airlines in the late 1970s and early 1980s. In this environment, CATA had to become a more efficient manager of existing facilities. Small capital improvements were undertaken, such as the construction of additional taxiways and improved navigational aids and air traffic control. Airport managers established scheduling committees in which they and the airlines determined how runway capacity would be allocated during peak hours. General aviation was discouraged from using major airports during peak hours. All of these measures were attempts to improve the efficiency of existing airports, while minimizing the dissatisfaction of important stakeholders.

The recession of the early 1980s, which led to sharp drops in traffic volumes for several years, bought some time for CATA and its airport managers. By the mid-1980s several factors were pushing Transport Canada to increase its emphasis on financial self-sufficiency for airports. The new Conservative government committed itself to the privatization of certain Crown corporations (for example, Air Canada, Petro-Canada) and the devolution of some functions previously housed in departments to special operating agencies (for example, the Passport Office) or self-financing corporations. In 1986 CATA was replaced by the Airports Authority Group (AAG) within Transport Canada.[2] The new structure has a mandate to run airports on a basis more closely approximating the self-financing nature of the private sector. Inspired by the privatization of the British Airports Authority, the federal government has also been moving in the direction of privatization of the airports, and negotiating to turn over airports to local authorities in Vancouver, Edmonton, Calgary and Montreal on long-term (60-year) leases.[3]

While devolution/privatization may be part of the government's political agenda, it is also a result of the difficult state of federal government finances. With an accumulated debt of $420 billion, and debt-servicing obligations of over $40 billion per year as its largest expenditure item, the federal government cannot afford to fund major capital projects at airports. Thus, the third terminal at Pearson International Airport was entirely paid for and is now owned by the private sector.

Airport development is also affected by the federal environmental assessment and review process which is now a requirement in the planning of expansion of any major airport. In this context airport opponents have an opportunity to argue their case. The government, as proponent of additional airport investment, must demonstrate that adverse environmental impacts can be minimized, and that any remaining environmental damage is outweighed by the user benefits. As a result, the AAG has begun to undertake benefit-cost analyses of major airport investments. Since the environmental assessment process is a slow-moving judicial process, lead times for airport planning are much longer than they were 20 years ago.

Both the unavailability of capital and the environmental review process have made airport expansion much more difficult. Meanwhile, demand has been growing since the late 1980s. Consequently, major Canadian airports have once again become congested. All possible minor capital investments (taxiways, navigational aids) have already been undertaken. Airport managers are continuing to use scheduling committees to mollify the airlines and general aviation. But the travelling public is becoming more inconvenienced and angered by delays, particularly at Pearson, the nation's major hub and most congested airport.

Today, the early 1990s, airport planners have come full circle. As in the mid-1960s, they are facing congested airports but unlike then, there is limited federal government money to solve the problem. We have moved from an airport management regime which was the "government ministry model" to one more closely resembling a highly-leveraged "private sector management regime" which is unable to assume more debt. While the concerns of the travelling public, the airlines, general aviation, and area residents continue to echo through the corridors of the AAG, its response is hampered by the federal government's woeful financial situation.

The following sections of this paper outline a model for airport management that puts the major emphasis on economic efficiency. As we will show, decisions made on that basis are different from those aimed at satisfying stakeholders or at achieving financial self-sufficiency. Furthermore, we will also illustrate how such an approach can mitigate the boom-or-bust airport expansion cycle we have witnessed in the last 30 years.

## 2.2 THE PLANNING FRAMEWORK

As already noted, the planning process for Canadian airports has been guided largely by physical standards rather than economic efficiency considerations. Such differences are not always recognized, particularly by physical planners who tend to draw on "economics" to justify investments they perceive necessary from their own physical or operational perspective. There is, of course, a fundamental difference between resorting to economic analysis (cost-benefit or economic impact) to justify desired projects, and the application of economic principles towards efficient use of existing or provision of additional capacity. This difference is evident from the recent airport planning experience in Canada, particularly with regard to the expansion of the two largest airports, Toronto and Vancouver. Background to the recent cost-benefit studies of both these airports, which are reviewed in more detail later in this report, reveals a distinct physical planning bias. In both cases, this bias has caused major efficiency losses before capacity could be expanded.

### Capacity Considerations

To compare traffic demand to runway capacity requires that "capacity" be defined in physical terms as some rate of throughput (movements per unit time). Following Transport Canada and the U.S. Federal Aviation Administration (FAA) standards, runway capacity in Vancouver was defined to be the rate of throughput at which average departure delay reaches four minutes.[4] This standard definition of capacity reflects the general finding that once average delay time exceeds four minutes it rises rapidly with further increases in throughput; as throughput approaches maximum physical capacity, average delay time approaches infinity. Given this definition of capacity, and assumptions about airport operating conditions, it is possible to calculate runway capacity.

The 1989 Vancouver study, by the Airside Capacity Enhancement (ACE) Project Team, used Transport Canada's Hourly Runway Capacity Computer Program to determine the throughput rate at which average departure delay at the Vancouver International Airport would be expected to reach four minutes, given a set of assumptions about weather conditions, aircraft mix and air traffic control procedures. This calculated value for existing runway capacity was found to be less than the existing throughput rate and, hence, capacity expansion was deemed to be required. Runway capacity was then recalculated to include short-term capacity improvements and compared to forecast traffic demand. From the finding that traffic demand would exceed runway capacity again within three years, it was concluded that there was a need for a new runway, the economic feasibility of which was to be assessed in a subsequent benefit-cost study.

If capacity expansion is defined to be the level of throughput that produces a four-minute average delay, then a second means of testing the need for capacity expansion is to compare the existing level of average delay to the four-minute standard. The ACE study, based on records of departure delays from May 1988, found average departure delays at Vancouver to be in the range of 6 to 11 minutes, indicating, under the standard definition of capacity, that capacity expansion was overdue. That average delay exceeded four minutes by a wide margin before the need for capacity expansion was identified is a reflection of the lack of any program for monitoring congestion delays at Vancouver prior to the ACE project.

Even if the delay monitoring program had been implemented early enough to identify average delays at the four-minute level, there is no guarantee that the methodology used in the ACE study would have lead to optimal timing of the benefit-cost study. This follows from the fact that capacity expansion may be justified in economic terms before (or after) average delay reaches four minutes. Capacity expansion is justified in economic terms when the (present-valued) benefits of capacity expansion exceed the (present-valued) costs of expansion. Since savings of congestion delay costs are the main benefits of capacity expansion, there is some critical level of average delay at which capacity expansion becomes justified. However, there is no guarantee that this critical level of average delay is four minutes; the critical level depends on a number of factors, particularly the capital cost of expansion, and may be less than or greater than four minutes.

Hence, definition of "capacity" without reference to the cost of capacity expansion can lead to identification of a need for new capacity either before or after it is justified in economic terms. Economic criteria require that the need for capacity expansion be assessed not by comparing delay time to a physical standard, the economic merit of which is not examined, but rather by explicitly comparing delay cost to capacity expansion costs. In planning for a new runway at Vancouver, such an economic criterion was not employed until the benefit-cost study stage of the planning process. The initial need for capacity expansion, and hence the timing of the benefit-cost study, were determined by application of physical standards rather than explicit economic criteria.

A similar physical planning bias was evident in the background to the proposed capacity expansion in Toronto. Recognizing that air traffic control could not cope with the scheduled movements, and that substantial delays were occurring, a decision was made to cap movements at 70 per hour, which was later increased to 76 per hour. In the meantime, a number of system improvements were planned to increase the capacity of existing runways to 96 movements per hour by the mid-1990s. Demand projections suggested that even this expanded capacity would be exceeded, and that additional runway options should be considered. However, the focus of the debate was always the comparison of hourly capacity estimates (that is, some measure of maximum throughput within certain technical standards) and peak demand. As the analysis later showed, even if peak hour demand did not exceed the estimated "maximum throughput," additional capacity could be economically justified. In other words, since operations at or near the estimated "maximum throughput" cause significant delays to build up in the system, substantial new investment could be justified through savings that result from the reduction of delays.

## Aversion to Pricing

The physical standards approach dictates not only the provision of additional capacity, but also the use of existing capacity. When congestion builds up, airport planners recognize the need to ration available capacity, but tend to revert to administrative rather than economic means. In Toronto, for example, the hourly cap determines the maximum number of flights that can be scheduled, and then available slots are allocated to different users. First, the cap typically represents a level of operation closer to "maximum" rather than "optimum" throughput. There is little recognition of delay costs imposed on different users within the cap, nor is there any mechanism to discourage demand through congestion pricing. Second, available slots are allocated through a reservations committee, which has certain priorities but no mandate to allocate slots to the users who value them most.

The current scheduling practices at Toronto's Pearson International Airport certainly go a long way to avoid congestion, but still fall short of optimal pricing. The physical planning tradition has always displayed a tendency to resist efficient pricing policies. As in most aspects of transportation infrastructure management, this tendency is also evident in Canadian airports. Generally, economists view the engineers' (or planners') aversion to pricing as an inherent disregard for efficiency.

In practice, economists have to take some of the blame for overselling the virtues of pricing, at least in the absence of "rational" investment practices. As discussed in greater detail later in this report, efficient resource allocation in airport planning has two aspects: pricing and investment. Efficient pricing would ensure the best use of existing facilities but, in the long run, economic efficiency criteria can be met only through appropriate levels of investment. In the Canadian airport policy debate, economists have argued that the need for new capacity would diminish greatly if efficient pricing policies were in place. Recent studies, however, have shown that airside capacity investments were overdue both in Toronto and Vancouver, with or without congestion pricing. Thus, the country's major airports suffered from under-investment, which could not be cured through efficient pricing alone.

However, there is a legitimate aspect to the general resistance to congestion pricing at airports. This largely stems from the users' mistrust that, even if justified by demand, funds are not properly invested in additional capacity. Any attempt to increase landing fees is generally perceived as a way of taxing users, rather than creating funds for new (or paying for old) investments in airport facilities. It is, therefore, not surprising that user groups favour a slot reservation system over peak-period pricing. In the absence of a transparent mechanism to channel funds into investment, their fears are indeed legitimate. Their efforts to ration available capacity among themselves is an attempt to squeeze out certain flights without placing a pricing burden on the rest.

### Investment Justification

Physical planners may not always present the most compelling economic rationale for new investments, but they rarely lose their zeal for facility expansion. The two key forces that have held them back in the last decade are no doubt lack of funds and community opposition. Planners tend to counter these forces with economic impact studies in which airports are presented as generators of economic activity. They provide jobs and contribute to the local or regional economy through purchases of goods and services. Through these "direct" wage payments and other expenditures, a series of secondary effects are induced as employees engage in consumption and suppliers interact with other local firms. These ripple effects through the local economy are generally captured by "multipliers" on the primary impacts, taking into account "leakages" along the consumption (or expenditure) chain.

The purpose of economic impact studies is to measure the direct, indirect and induced effects of an airport. In other words, the studies try to capture the contribution of airport-related activities to the local economy, or local economic activity that may disappear with the removal of the airport. The methods and estimation techniques vary greatly, but all these studies try to impute an economic value or worth to an airport. The fundamental principles of impact studies are derived from basic regional economic theories, which strive to understand the spatial dynamics of economic activity, or spatial linkages between firms or industries. These concepts have been embraced by airport planners with somewhat different motives, mainly to establish the significance of their airport's role in the local economy.

Opposition from local residents to any expansion plans, and difficulties in securing investment capital, motivate airport planners to justify their role and enhance their profiles in the community. It is only natural to focus on such issues as local job and revenue generation to mobilize local support for new facilities, particularly in the U.S. where airport authorities tend to be locally governed. Especially when local financing is required, economic impact studies serve not only as a powerful public relations tool but also as an effective mechanism to solicit public investment funds. It is understandable how economic impact studies became a fad throughout North America, virtually a compulsory undertaking for all local airport authorities through the 1970s and 1980s.

In Canada, economic impact arguments played a major role in justifying the construction of Mirabel Airport, especially since the project was promoted largely as an economic development initiative. The new airport was going to attract development opportunities that would otherwise locate elsewhere, and generate substantial local activity that would otherwise be foregone. Similar arguments were advanced for Pickering where, of course, they were never given a chance to be disproven as in the case of Mirabel.

Although the era of new airports closed with the death of Pickering, economic impact studies continued to play a visible role in the airport planning scene in Canada. In the last decade or so, every major airport in Canada has commissioned at least one economic impact study. The first such study for the Malton (now Pearson) airport in Toronto was in fact funded out of the "left-over budget" from Pickering, within a year of that project's cancellation. Similar studies followed in Edmonton, Calgary, Vancouver and some smaller airports. The earlier study of the Malton airport pre-dated some of the methodological advances in the economic impact culture that swept the U.S. through the late 1970s and early 1980s. In the late 1980s, the authorities felt the urge to commission a new, state-of-the-art economic impact study.

Economic impact studies play an integral role in establishing the importance of airports in the local or regional economy. They no doubt counter local opposition and mobilize political support. Similarly, they are useful in promoting the devolution of airports — which, as discussed in the next section, constitutes a cornerstone of the federal government's airport policy. As local governments understand the economic role of airports, they would naturally be drawn closer to the idea of owning and managing them, as a means of exercising more control or influence over local economic development initiatives. Despite these useful functions, however, a more critical — if not cynical — view of economic impact studies is difficult to avoid when they are being used to justify the building of new, or expansion of existing, airports — in other words, as an investment appraisal tool.

As evident from the Mirabel experience, airports cannot generate economic development; they can only facilitate development if the potential is there in the first instance. The same arguments prevailed throughout the eventually aborted Pickering project. Ironically, airport officials did not appear any wiser a decade later when they were preparing their case for the expansion of Pearson International Airport. Before any serious effort was made to examine the costs and benefits of airside capacity expansion, planners turned their attention to economic impact studies in the hope of proving that Toronto could not afford not to expand its airport. It should have been abundantly clear that the regional economy would be adversely affected by a congested airport, but it was somewhat ridiculous to try to justify a new investment based on potential job and revenue generation in an already overheated economy. As it turned out, benefits from reduced congestion would easily justify significant investment in new runways. The obvious lesson to be learned from this experience is that economic justification for any project lies with demand for that project, not with its consequences or impacts. Thus, expenditures on airport expansion should not be considered a net benefit or a measure of the airport's economic impact, because if the airport were not expanded, those resources would be used on some other construction project.

In conclusion, economic impact studies or statements may have considerable promotional value, continuing to play an important role in support of the federal government's devolution efforts. However, they are inadequate as an investment appraisal or project evaluation tool. As argued throughout this report, justification for airport investments can only be found through sound benefit-cost studies — in other words, economic efficiency must be established, as in all resource allocation decisions. In recent airport planning in Canada, preoccupation with economic impact studies has detracted from more serious and rigorous cost-benefit studies. Even from the perspective of community relations, economic impact studies prove to be of limited value. Local residents affected by negative externalities (for example, noise) take little comfort in positive economic impacts on their community (for example, jobs supposedly created for others).

## 2.3 THE POLICY CONTEXT

The current policy is moving in a new direction, offering greater comfort to the efficiency-minded economist in the Canadian airport planning scene. The three pillars of current federal airport policy — devolution/privatization, cost recovery and environmental assessment — provide encouraging signs that the efficiency of the Canadian airport system is likely to be enhanced.

**Devolution and Privatization**

When the Canadian Air Transportation Administration under Transport Canada was replaced by the Airports Authority Group in 1985, it took charge of some 200 airports across the country. At the time they had an estimated replacement value (in 1985 dollars) of almost $8 billion. With a capital budget of more than $200 million, an operating-maintenance budget of almost $400 million and approximately 4,500 employees, the AAG became a very sizeable operating entity. The total revenues of some $330 million in the first year of operations were generated from terminal fees, landing fees, rentals and concessions. The portion of air transportation taxes allocated to the AAG (approximately $280 million in 1985-86) brought the organization's total revenue to more than $600 million.

In the transformation of CATA into the AAG (and the remaining components — safety, regulation and air navigation — into the Aviation Group), the federal government was motivated primarily by the need to create a commercially minded, businesslike organization. This was evident from the government's policy statement at the time, "Future Framework for the Management of Airports in Canada." The new policy package had two principal thrusts: transfer of Transport Canada-owned airports to local groups, and implementation of the Transport Canada Airports Authority Model in the remaining airports. Devolution is slow in coming, since Bill C-85 (*Airport Transfer Act*) is still before the House of Commons. Nevertheless, during the first few years, the AAG completed the transfer of 50 Arctic B & C airports to the governments of Yukon and Northwest Territories. This year, financial and employee benefit packages appear to have been concluded for the Edmonton, Vancouver, Calgary and Montreal airports, with the actual transfer to be completed shortly. In addition, the following initiatives are under way:

- An agreement has been reached to secure local authority financing (for example, through municipal bonds) for expanded airside and terminal capacity at the Vancouver International Airport.
- Base cases for Quebec City, Moncton, Windsor, Thunder Bay, Winnipeg and Kamloops are completed, and transfer negotiations will soon follow.

- Another round of transfers is expected to be completed in the next fiscal year (1992-93) and, by the following year, as many as 25 more airports will be transferred.

In addition to devolution, the AAG has also undertaken initiatives to secure direct private-sector involvement in the design, construction, financing and operation of facilities. In this regard, the most significant project was the development of the privately owned Terminal 3 at Toronto's Pearson International Airport, which opened in February 1991 with 24 gates and a capacity of 10 million passengers per annum. This $550-million infrastructural investment required less than $10 million in government expenditures, with foregone revenues estimated to be well below the costs of operating and carrying (that is, interest on capital costs) a project of this magnitude. The AAG is currently working on a tender package for the private-sector redevelopment of Terminals 1 and 2 at the Toronto airport. In addition, efforts are being made to involve private-sector interests to buy or lease smaller airport facilities as part of the overall devolution thrust.

As noted above, the operating costs of the AAG during its first year were about $400 million; by 1991-92, costs were down to $371 million and, by 1993-94, they are projected to be below $300 million. The downsizing is largely due to the transfer of airports to local authorities. Although detailed productivity studies are not available, the AAG has also been trying to improve the efficiency of its remaining operations. Together with improved cost effectiveness, there is also a thrust to expand the revenue base through both landing/terminal fees and concessions/rentals.

From our perspective in this research report, organizational aspects are not that critical in the pursuit of efficient pricing and investment policies, at least not in theory. The type of pricing and investment policies recommended throughout this report could have been implemented within the old departmental structure under CATA. However, the institutional record over the last two decades has proven that the bureaucratic environment was not conducive to the pursuit of economic efficiency in the running of existing, or the building of new, facilities.

The more business-minded approach brought about through the creation of the AAG is likely to promote more efficient pricing and investment practices. It should be obvious that a commercially driven organization, as opposed to the old bureaucratic structure, will foster greater economic efficiency. At the same time, the devolution of both management and ownership helps bring about greater local accountability. This would tend to reduce the dangers of over-investment (for example, building of white elephants like Mirabel), while reducing the tolerance for under-investment through increased responsiveness to airport congestion. In general, the devolution and privatization thrust of the new airport policy framework is a positive development from an economic efficiency standpoint, though not necessarily a theoretical prerequisite to an efficiently run airport system.

### Cost Recovery

Another important dimension of federal policy on airport finance and management is cost recovery. The first discussion paper outlining Transport Canada's cost-recovery policies was released in May 1987. This document formed the basis of subsequent consultations with various user and interest groups, leading to the publication of the second discussion paper in April 1990. Following another year of consultations, there now appears some speculation that the implementation of the policy package may be delayed, or even abandoned. In any event, the policies in question are of considerable interest from the perspective of this report.

Transport Canada's cost-recovery policies are no doubt part of the government's overall efforts to reduce the deficit. The underlying principles are stated as follows:[5]

- Ensure that users bear a fair share of the costs of facilities and services from which they derive benefits;
- Relieve the general taxpayer of financial burdens properly borne by users of the transportation system;
- Impose greater discipline on user demands for additional or better facilities and services; and
- Improve the efficiency of the transportation system, an objective that can be met through increased cost recovery because it will enable user demand, investment decisions, and modal choices to be based on a truer perception of the cost of service.

The relevance of these principles to airport pricing and investment, is underlined by the cost-recovery paper's assessment of airport revenues:

- Airports are presently classified into groups for cost-recovery purposes. Major fees (for example, landing fees) are the same for all airports in a particular group but are lower for smaller airports. Landing fees are established on a "residual" basis, meaning that they are justified by the shortfall, for any given group of airports, between total airport costs and all other airport revenues. Historically, landing fees have never fully recovered these shortfalls. This approach has resulted in fees that are not closely related to the costs of the specific facilities and services at particular airports.
- The largest single source of revenue from the air mode is the air transportation tax (ATT), an excise tax collected from domestic and international passengers. Unlike the proceeds of all other excise taxes which are treated as a general source of government revenue, the revenues from the ATT are credited to Transport Canada to help pay for air transportation facilities and services in general.

In determining capital costs, cost-recovery policy focusses on "net book value." While the AAG estimated the replacement value of airports at more than $8 billion, for cost-recovery purposes, the net book value was estimated at about $1.5 billion as of March 31, 1988. Using an average pre-tax return on total net assets of regulated industries in Canada, and including a provision for risk, annual capital costs of the AAG were estimated at approximately $218 million for the year 1987-88. With the appropriate adjustments and the inclusion of non-attributable components, total expenditures (that is, together with operating and maintenance costs) for cost-recovery purposes were estimated at $546 million.

Once the attributable costs are determined, cost-recovery policy deals with their distribution among user groups. The main users of airports are domestic commercial transport services, international commercial transport services, state and military aircraft and general aviation. Proposed cost- recovery policies view most of the airfield facilities at major federal airports as primarily intended to serve commercial transport operators, thus allocating all of the associated capital costs to these users. The operating and maintenance costs of airfield facilities are proposed to be distributed among all users, per tonne of maximum take-off weight. The costs of special general aviation airports would be attributed to that user group. Terminal building costs would be divided into those associated with the passenger-processing part of the building, the space used by concessionaries (that is, commercial space) and the terminal building's car parking facilities. Based on these considerations, the principal cost-recovery proposals regarding airports are the following:

- The costs of airfields and terminal buildings should be recovered through site-specific charges.
- Airport user-charges should be established on a compensatory basis, in relation to the attributable costs of the airfield and the passenger-processing part of the terminal building.
- Airport airfield costs should primarily be recovered through landing fees, based on aircraft maximum take-off weight, applicable to turbo-prop and jet aircraft. The concession fees on turbo and jet fuel should be eliminated, and landing fees should be increased in such a way as to leave revenues unchanged. By exception, piston-engined aircraft should pay a concession fee on aviation gasoline and, where appropriate, an additional landing fee at large airports.
- Air terminal building passenger-processing costs should be recovered through general terminal charges based on standard aircraft seating capacities. A higher charge should be levied on aircraft in international service to reflect the additional space needs of their passengers (for example, for inspection services, well-wishers/greeters and longer dwell-times).

In addition, cost-recovery policy makes provision for peak-period charging at major airports where traffic exceeds capacity for considerable periods of time. The rationale is as follows:

- Facilities are sized to accommodate a substantial portion, but not all, of peak-period demand;
- Larger facilities, made necessary by peaks in demand, result in additional capital and operating costs; and
- These incremental costs should be borne, to the extent practicable, by the users who occasion them.

Although the cost-recovery statement provides the underlying principles, a more detailed methodology remains to be worked out with regard to both passenger-processing and airfield facilities. In the meantime, minimum landing fees, and two related provisions for Toronto and Vancouver (concerning fees payable by large piston-engined aircraft, and concerning the AVGAS concession fee) have been proposed.

The implications of the proposed cost-recovery policies from a pricing perspective are dealt with in more detail later in this report. There are some conceptual differences between the cost-recovery approach, on the one hand, and theoretical principles of social marginal cost pricing on the other. However, the proposed cost-recovery framework provides the essential elements of an efficient pricing system. Although this is clearly a positive development, it is now doubtful that the cost-recovery policy package will proceed as planned.

### Environmental Review

As in all aspects of socio-economic activity, airport-related policies are also taking on an increasingly important environmental focus.[6] In the current fiscal year, the AAG notes the following key initiatives with respect to the environment:

- Guidelines for restrictions on night flights have been established and a major program for Noise Management has been instituted at Toronto Pearson.
- A 5-year program for the destruction of Polychlorinated Biphenyls (PCBs) throughout Transport Canada has been developed and program documentation completed.
- All international airports and each region now have a senior environment officer on staff.

For the next fiscal year, the following are noted:

- The Airports National Environmental Action Plan developed in response to the Federal Green Plan will be implemented. The key elements will be programs to identify and test sites for contamination, testing of underground storage tanks as well as the PCB program.

- While much planning and preliminary survey work will be accomplished, physical progress will undoubtedly be retarded due to the budgetary situation.
- . . . to shift our environmental focus from reactive to proactive, a comprehensive program of environmental audits, air and water quality monitoring, and development of environmental guidelines will be implemented.

Generally, airports and the environment are perceived to be in a perpetual state of conflict. As environmental concerns grow and public policy becomes more sensitive towards environmental quality, airport operators feel more pressure and encounter more constraints on the planning process. However, economic efficiency is not always in conflict with environmental objectives. For example, airplanes generate noise which has an impact on neighbourhoods in the immediate vicinity of airports. These, in fact, are costs borne by local residents, which are in principle not very different from operating costs incurred by airlines themselves. They are all "economic costs" associated with air travel; the difference is that some are borne "internally" by providers or users of commercial services, while others are imposed "externally" on other parties.

All costs, internal and external, have to be incorporated into efficient pricing practices. For example, air travellers should be paying for environmental costs they impose on society at large, in the same manner as they pay for airport facilities they use. In general, as environmental concerns come to the forefront of public policy debates, increasing attention will no doubt focus on external costs (noise, air or other environmental costs) generated by airport activity. However, this development, in and of itself, should not compromise economic efficiency, but place greater pressure for "prices" to reflect both internal and external costs.

Apart from pricing considerations related to existing airport activities, heightened environmental concerns also affect investment policies and practices. For example, as new airports are built, or existing ones expanded, more stringent environmental review and assessment are required. Recently, the proposed airside capacity expansions at both Toronto and Vancouver international airports came under the Environmental Assessment and Review Process (EARP), administered by the Federal Environmental

Assessment Review Office (FEARO). In both Toronto and Vancouver, the Minister of Environment appointed a panel to review Transport Canada's proposals. In each case, Transport Canada prepared detailed environmental impact statements (EIS) which were scrutinized by the panel through consultations and public hearings.

The EARP naturally slows down major projects. While placing an administrative burden, however, the EARP also imposes a greater degree of financial or economic discipline on public investment projects than that which might exist in the absence of such a rigorous review. Most environmental impact statements, particularly with regard to major airport projects, are expected to include a rigorous benefit-cost study. While other Treasury Board guidelines may also require similar financial scrutiny, the rigour with which the cost-benefit studies were conducted in the case of both Toronto and Vancouver airside expansion projects could in large part be attributed to the EARP requirements. It is doubtful that some of the white elephants of the past would pass the scrutiny of today's review standards. Thus, rather than hindering economic efficiency, the environmental review process has, somewhat ironically, enhanced it.

## 3. THE AIRPORT INVESTMENT PROBLEM

Airports, like other large, public infrastructure facilities, are characterized by indivisible capacity — capacity that cannot be expanded continuously, but rather only in large lumps. Improvements to navigation and control facilities, taxiways, passenger handling facilities and access roads can enhance the capacity of existing runways and terminals to a limited extent, but, as usage increases, eventually new runways and terminals are required.[7] At that point it is not technically and/or economically feasible to construct half of a runway or half of a terminal: expansion of runway and terminal facilities requires a large, fixed investment. The lumpy nature of capacity expansion means that new capacity may initially be under-used but, as traffic volume increases, congestion builds and congestion delays mount. This section of the report deals with economic criteria for airport investments, first, from a theoretical perspective, then followed by two case studies dealing with airside capacity expansion at major airports.

## 3.1 THEORETICAL CONSIDERATIONS

### Decision Criterion

The relevant economic criterion for evaluating public policies that affect diverse groups is the maximization of net social benefits. This criterion, by definition, accounts for the benefits and costs that accrue to all individuals who are affected by a policy, to arrive at a measure of the net benefit of the policy to society. The concept of net social benefit (NSB) encompasses not only private costs and benefits that accrue directly to providers and users of a service but also external costs and benefits that accrue to third parties. Hence, an evaluation of the proposed construction of a new runway that uses the NSB criterion would weigh the costs of the runway, both to airport operators and to the surrounding community who suffer noise and environmental disamenities, against the benefits of the runway, both to those who use it and, potentially, to those who receive economic spin-off benefits. The NSB of the policy of constructing the runway is then the sum of all social benefits minus the sum of all social costs.

The establishment of net social benefit as an economic criterion for decision making requires that costs and benefits be valued in some common unit, such as dollars. To ensure that the NSB reflects society's strength of preference for a policy, costs and benefits that have no existing market value are assigned the values placed on them by the affected individuals themselves, as revealed by their willingness to pay to receive a benefit or to prevent a cost.[8] When benefits and costs are defined in this manner, the NSB represents the increase in "social welfare" or "economic surplus" attributable to the policy, that is, society's valuation of the policy minus the social cost of providing the policy.

A policy with a positive, or even a maximal, net social benefit is not necessarily a policy that will make everyone better off. Positive NSB requires only that the benefits to those who gain from a policy exceed the costs to those who lose from a policy. The rationale for adopting a policy with positive NSB is, therefore, that it is possible to redistribute the impacts of the policy in such a way that no individual is made worse off, but some individuals are made better off, by the policy. Specifically, the gainers could hypothetically compensate the losers and still have some gain left over. The losers would then be no worse off than before the implementation of the policy-compensation package, since their social cost, as measured in the NSB, equals their willingness to pay for the removal of the policy and therefore, the amount that they are willing to accept in compensation for the retention of the policy. This is known as the "compensation principle."[9] A policy that has positive NSB is deemed to be socially worthwhile because *if* those who benefit from the policy were to compensate those who lose, everyone would be at least as well off as before the implementation of the policy.

While maximization of the net social benefit may be a sound economic criterion upon which to choose among policies, it may raise political problems. For example, a NSB-maximizing policy, while conferring positive net benefits on society, may impose large losses on some individuals because a positive-NSB policy does not necessarily require that losers be compensated; the formula is that *if* they were compensated and there was still residual benefit to gainers, then the policy would be deemed positive. If the costs of a positive-NSB policy are concentrated among a group of individuals (such as those who inhabit the neighbourhood of a facility), while the larger benefits are spread thinly across the travelling public, each losing individual has a greater incentive to lobby against the policy than does each member of the general public to lobby for the policy. The likely result in such a case is the formation of interest groups opposed to a policy which, in terms of economic efficiency, benefits society as a whole. The implication of such interest group dynamics is that the use of the NSB criterion in policy selection may be constrained by the intrinsic nature of representative democracy.

In addition, the manner in which gains and losses are distributed among members of society may be of social concern. It may be a political objective to select policies that not only maximize the NSB — the size of the economic pie — but also that distribute costs and benefits — shares of the pie — according to some equity criterion,[10] for example, access.

Another type of equity criterion of potential political concern is the impact of a policy on low- versus high-income groups. The political objective of choosing policies that equalize the distribution of income across society is not reflected in the NSB criterion as formulated here. Summing costs and benefits across all individuals in an unweighted manner to obtain the net social benefit implicitly assumes constant marginal utility of income, that is, that low-income individuals value a dollar benefit or cost the same as high-income individuals. A criterion which sought to equalize society's income distribution would assign more weight to a dollar benefit received by a low-income person than to a dollar benefit received by a high-income person. Therefore, the assumption of equal marginal utility of income is tantamount to overlooking the income-distributional effects of a policy, or assuming that they are negligible.[11]

## Investment Timing

The airport planner's long-term decision problem is to determine the optimal quantity and timing of capacity expansion. If the planner's sole concern is economic efficiency, then the optimal capacity expansion path is that which maximizes the net social benefit of expansion. A solution to the problem is therefore a decision rule that identifies the NSB-maximizing quantity and timing of capacity expansion.

In practice, this decision rule is constrained by technical (physical and engineering) and economic (economy of scale) considerations that limit the quantity of capacity expansion to a few feasible options at any given time. The incremental benefit and cost streams (in comparison to some common base-case option) associated with initiating each of these expansion options at that given time can be simulated and the net present value (NPV) of each calculated. According to conventional benefit-cost practices,[12] the optimal policy would simply select the expansion option with the largest positive NPV, or the base case if the NPV of all other options were negative. The selected option would then be subjected to sensitivity analysis to determine whether delaying its implementation would raise its NPV.[13] However, such a policy, which considers the optimal timing of the selected option (the option with the highest NPV for current construction) but not the optimal timing of the other options, would not necessarily expand capacity in a manner that maximizes the NPV of net social benefits.

An optimal capacity expansion policy must optimize over both the quantity and the timing of capacity expansion. In particular, the policy must account for the possibility that start-dates other than the present for *all* options may change the preferred option. That is, the option with the highest NPV for current construction may not be the option with the highest NPV for future construction. In order to account for this possibility, the optimal decision rule for capacity expansion must in general determine the NPV-maximizing start-date (optimal timing) for each expansion option, and then select the *optimally timed* expansion option with the greatest non-negative NPV.

The optimal timing for a given capacity expansion option is determined through a comparison of the incremental benefit of delaying expansion by one period to the incremental cost of such a postponement.[14] The benefit of delaying expansion by one year is the saving of the opportunity cost of capital in that year.[15] The cost is the lost net benefit (congestion savings less maintenance and externality costs, all over the base case) that capacity expansion would have produced in its first year of operation. The delay is justified as long as the benefit of delaying expansion by one year exceeds the cost of same. If congestion in the absence of expansion increases monotonically over time, and hence the annual benefit of expanding capacity increases monotonically over time, then the cost of delaying capacity expansion by one year increases over time.[16] By contrast, the benefit of delaying expansion by one year (the interest savings on expansion capital) is constant over time.

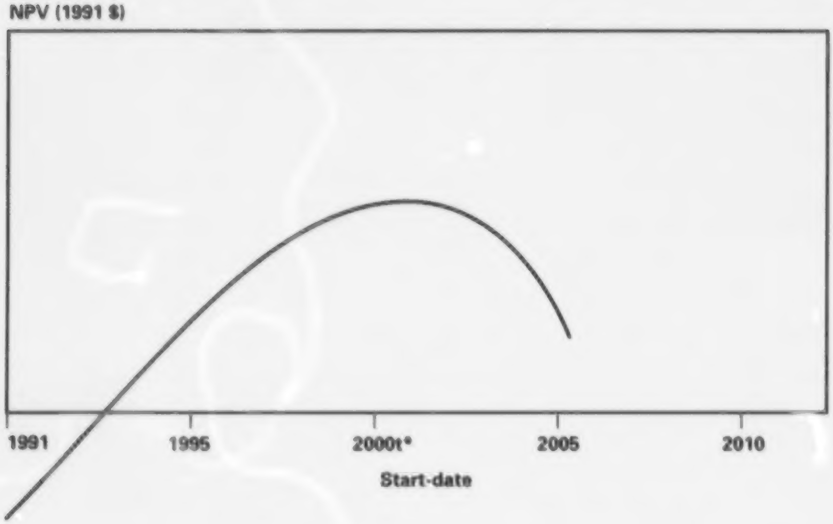
Given these assumptions, it follows that there will be a unique point in time at which the benefit exactly equals the cost of delaying capacity expansion by one year. This point is the start-date that maximizes the NPV of the expansion option, t* (see Exhibit 1). Before this optimal start-date, the cost — foregone benefit — of delaying expansion is less than the benefit — interest savings — of delaying expansion; hence, delaying the implementation of the expansion option increases its NPV. After the optimal start-date, the cost of delaying expansion exceeds the benefit and so further delay leads to a decrease in the NPV of the expansion option. Therefore, assuming monotonically increasing benefits to expansion over time, the optimal year in which to initiate an expansion option is the first year in which the net benefit of expansion exceeds the opportunity cost of expansion capital; that is, the first year in which

$$(B_t - M_t - E_t) \geq rK$$

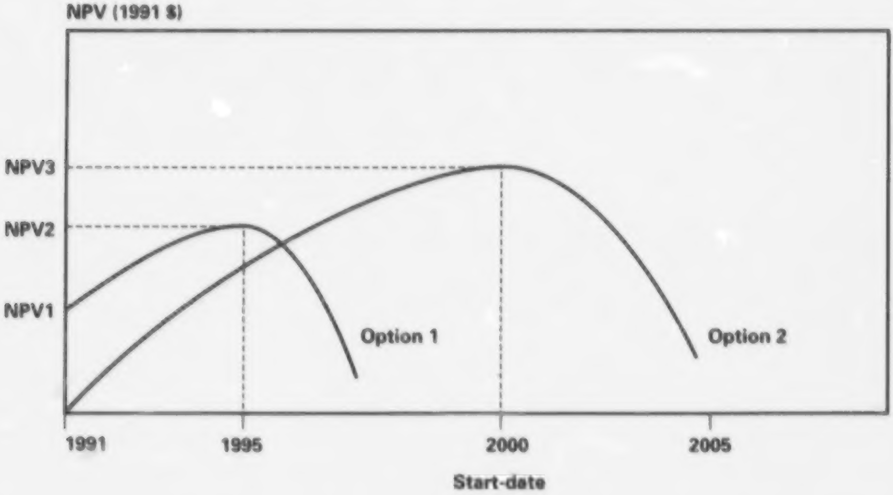
where $B_t$ is annual congestion cost savings, $M_t$ is annual incremental operations and maintenance cost, $E_t$ is annual incremental external cost, r is the social discount rate, and K is the capital cost.[17,18]

*Exhibit 1*

### VARIATION OF NPV WITH START-DATE



### VARIATION OF RECOMMENDED OPTION WITH START-DATE



The existence of a unique optimal start-date for any expansion option stems from the assumption that the net benefits to expansion (exclusive of capital cost) increase continuously over time. If the assumption of monotonically increasing net benefits is not satisfied, then the decision rule for optimal timing presented above does not apply, and the optimal timing for initiating an expansion option must be determined by simulating each possible start-date and selecting the start-date that maximizes NPV.[19] However, the assumption of monotonically increasing net benefits is likely to be valid for airport investments, because indivisible capacity means that, in the absence of capacity expansion, congestion rises with demand and, hence, that the benefits of capacity expansion increase over time.

Selecting the recommended expansion option from among the set of optimally timed expansion options ensures that the NPV of capacity expansion is maximized over both the quantity and timing of capacity expansion. Use of a decision rule that chooses between expansion options timed to start at the present date rather than at optimal start-dates can alter the choice of expansion option, and hence expand capacity in a manner that does not maximize NPV. Exhibit 1 also provides an example of non-optimal decision making under a decision rule that maximizes present-year NPV for present-year start-dates rather than over all possible start-dates. In Exhibit 1 (bottom), Option 1 and Option 2 represent two technically feasible expansion options. For each option, potential start-dates are plotted against the 1991 NPV of implementing the option at each start-date.

Option 2 represents a larger capacity expansion than Option 1, with larger capital costs and larger congestion relief benefits, particularly in later years. Because of its larger capital cost, a greater level of congestion cost is required to offset the interest savings benefit of delaying Option 2; thus the NPV of Option 2 is maximized at a later start-date (2000) than is the NPV of Option 1 (1995). Although the greater capital cost of Option 2 causes it to have a later optimal start-date, and to have a lower NPV than Option 1 for early start-dates, the greater benefits of Option 2 in later years gives Option 2 a greater 1991 NPV than Option 1, subject to being able to delay initiation of Option 2 to the year 2000. A policy that chose between the two options based only on 1991 start-dates would select Option 1 and accrue NPV1 in 1991. A policy that further evaluated the optimal timing of its recommended option, Option 1, would find justification for delaying Option 1 until 1995 to raise the 1991 NPV of the project to NPV2. Yet this policy would not maximize

NPV in 1991. An optimal policy would evaluate the optimal timing of both options and recommend implementation of Option 2 in the year 2000, accruing the maximal NPV of NPV3 in 1991 dollars.

Hence, in general, it matters whether optimal timing analysis is performed before, rather than after, the selection of the recommended expansion option. In certain specific cases, the same option would be chosen regardless of whether optimal timing were considered before or after option selection. One such case of particular interest occurs when all options are "overdue" (past their optimal start-dates); the optimal timing for all options is then the present, and so a simple choice of the option with the greatest NPV based on a present start-date will maximize present-date NPV. This may have been the case identified in the recent runway expansion studies for Pearson and Vancouver international airports, both of which found the recommended option to be overdue and recommended immediate implementation.[20] While these recommendations may have been justified in a second-best sense, for a long-run planning policy the first-best solution would implement capacity expansion at, rather than after, the optimum time.

To devise a long-run planning policy that achieves both the optimal quantity and timing of capacity expansion would require looking beyond decision-rules for benefit-cost studies to the timing and frequency of the studies themselves. There would be a trade-off between the administrative costs of more frequent study and the benefits of improved timing. The conventional benefit-cost approach to long-run investment planning offers a robust solution to only half of the planner's long-run investment problem. The conventional approach tackles the question of *what* investment should be made at the current time, and then asks *when* this investment should be undertaken. An optimal solution would take a longer-term view of the long-run investment planning problem by focussing first on *when* each of a number of feasible investments would best be undertaken, and then asking which of these optimally timed options should be undertaken over time. Hence, the optimal long-run investment policy first determines the optimal timing of each feasible expansion option, which occurs in the first year that the net benefit of expansion exceeds the opportunity cost of expansion capital.[21] The optimal policy then selects the option which, constructed at its optimal time, produces the largest NPV in the present.

## 3.2 VANCOUVER INTERNATIONAL AIRPORT[22]

### Scope

Following the economic recovery that began in 1985, aircraft movements at Vancouver International Airport (YVR) grew rapidly, increasing at an average annual rate of 11 percent during the period 1984-1988. The increased aircraft activity stemmed from the growing role of YVR as a hub for regional air services in the wake of airline deregulation and from a surge in Pacific Rim traffic. In response to mounting traffic and observable aircraft delays, Transport Canada initiated the Airside Capacity Enhancement (ACE) Project in 1988. The ACE project documented the existence of airside congestion at YVR during peak periods and identified short-term measures to enhance airside capacity.[23]

These measures included modifications to the existing runway system, air navigation technology improvements, modifications to air traffic control procedures, and a $25 peak-period minimum landing fee intended to shift some piston aircraft to other airports. Together, these measures were expected to boost YVR airside capacity by eight percent; this would constitute the base case for the study. Since even with full implementation of these measures traffic was expected to grow sufficiently to match capacity and delays to re-emerge by 1991, the need for a new runway was identified.

Several options for expanding capacity were formulated for comparison with the base case, each of which included the base improvements to existing infrastructure. These capacity expansion options were imposition of a $25 or $100 peak-period minimum landing fee; construction of a new runway of either 5,000, 8,000 or 9,400 feet in length parallel to the existing main runway; a $25 or $100 peak-period fee in combination with a parallel runway; and $100 peak-period fee in combination with construction of enhanced airside and terminal capacity at alternative Lower Mainland airports. The last option included enhancement of Abbotsford International Airport to allow it to function as a second airport for mainline carrier traffic, enhancement of surface transportation between the two alternate airports, enhancement of Boundary Bay Airport to attract non-commercial traffic, and a $100 peak-period minimum landing fee at Vancouver International to encourage use of the alternate facilities. Peak fees under all options would be levied during the 12-hour period of sustained demand at YVR on weekdays from 7 a.m. to 7 p.m.

The wide range of investment options considered in the study ensured that runway expansion at YVR would be recommended only if it was found to have greater economic merit, that is, net present value (NPV), than all other methods of alleviating congestion. In addition to the base-case efficiency improvements and alternate airport development, consideration of pricing as an alternative to investment was an important aspect of the study. The inclusion of peak-period pricing, both alone and in combination with a parallel runway, ensured that a parallel runway would be recommended only if justified as an alternative to or in addition to peak-period pricing.

If pricing alone were found to have greater economic merit (NPV) than runway construction alone, then comparison of the merit of the runway plus pricing combination with the merit of the pricing alone option would indicate whether runway construction was justified in addition to pricing. On the other hand, if runway construction were found to have a higher NPV than pricing, then comparison of the NPV of the runway plus pricing combination with the NPV of runway construction alone would indicate whether pricing was justified in addition to runway construction. In either case, the runway plus pricing option would not necessarily be superior to either the runway alone or pricing alone options because investment and pricing are alternative measures for dealing with congestion. Since both rely on the existence of delays for their justification, implementation of both runway construction and pricing would be justified only if sufficient congestion remained after implementation of either a runway or pricing alone.

In accordance with the requirements of benefit-cost analysis, the study considered not only a wide range of options but also the social benefits and costs of each option. The benefits of each option in comparison with the base case stemmed from reductions in congestion delay costs, whether by diverting some aircraft from peak periods to off-peak periods or alternative airports, or by expanding runway capacity at YVR. The latter options allow traffic to increase above base-case levels simultaneously with reduction in delay costs. This "generated" traffic, which would not have used YVR without runway expansion, accrues consumer surplus benefits under the runway expansion options that are additional to delay savings that runway expansion accrues to base-case traffic. Options that use peak pricing to alleviate congestion delays at YVR lead to net decreases of peak traffic at YVR and hence do not generate traffic in excess of base-case traffic.

Rather, under pricing options, a portion of base-case traffic is diverted from YVR, and this diverted traffic incurs a consumer surplus loss.

The second major type of benefit of capacity expansion is the incremental macroeconomic benefit of increased airport-related activity that results from generated traffic. Macroeconomic benefits can be attributed to an expansion option only if they would not have accrued to the economy if the resources used to expand airport capacity had been put to an alternate use. In the study of capacity expansion options at YVR, macroeconomic benefits were calculated but were displayed alongside rather than incorporated into option NPVs. Prudent investment planning dictates that decisions be made on the basis of user benefits alone because "the stimulative macro-economic effects of infrastructure projects are very small in relation to the overall volume of macro-economic activity and thus a great deal less certain than estimates of user benefits. As well, uncertainty of the stimulative impact of alternative uses of capital funds creates a risk of double counting benefits."[24]

## Approach

Estimation of the capital and O&M costs of airport investment options can be based on the well-defined procedures for engineering costing and economic impact assessment. In the benefit-cost study of capacity expansion options at YVR, one measurement issue relating to capital costs concerned the allocation of the capital and O&M costs of surface transportation improvement to the alternate airport development option. A sensitivity analysis approach was taken to gauge the effect of allocating either 50 percent or 100 percent of surface transportation costs to the option. A second measurement issue concerned the cost of the land on which a parallel runway would be built. The study valued land costs at zero, arguing that there would be no alternative use for the Sea Island lands if a new runway were not built. The Federal Environmental Assessment Panel that reviewed the benefit-cost report argued that the land should have been valued on the basis of airport-related commercial development.[25]

The measurement of the user benefits and costs of airport capacity expansion require special attention involving forecasts of peak-period traffic volumes and average delay times. The reduction in average delay time over the base case engendered by an option can then be applied to the base-case traffic volume to obtain a measure of total delay minutes saved. If an option alleviates congestion by diverting aircraft movements to off-peak times or alternate airports, delay time savings are calculated by applying average delay time savings to the remaining traffic volume. In both cases, delay minutes saved can be converted to dollar benefits by using readily available information on per-minute aircraft operating costs, aircraft load factors, and the value of business and non-business passenger time.

Consumer surplus benefits and costs to generated and diverted traffic can also be calculated directly from forecast traffic volumes and delay cost savings, provided that assumptions are made about the price elasticity of demand for aircraft movements. The benefit to each generated traffic movement (in excess of base-case traffic) is a fraction of the delay cost savings to base-case traffic movements, where the fraction is determined by the demand elasticity. In the YVR study, fractions in the range of one half to one third were used, reflecting the assumption of demand curves between the linear and log-linear form. Consumer surplus losses to diverted traffic movement were similarly calculated as a fraction of the increase in peak-period fees.

Hence, the key requirements for estimation of the user benefits and costs of airport capacity expansion are the ability to forecast peak-period traffic and the ability to translate peak traffic into average delay times under the capacity specified by each option. In the YVR study, forecasting of peak traffic for the base-case and runway options was relatively straightforward. The number of annual originating and destination passengers was first forecast on the basis of provincial population and disposable income growth. This traffic was then grossed up by a hubbing ratio to account for connecting enplanements and deplanements. Annual enplanements and deplanements were then translated into annual runway movements by making assumptions about aircraft sizes and load factors. Finally, annual runway movements were translated into representative peak-period runway movements on the basis of existing peak patterns.

The traffic forecasting process is complicated by the need to recognize the impact of congestion delay on traffic demand. As traffic increases, congestion delays increase as well, increasing the cost of using the airport, and decreasing the demand for aircraft movements. The effect of delay costs curtails traffic and delays growth in the base case, leading to decreased delay savings benefits (but increased traffic generation) from construction of new runways.

Ideally, traffic and congestion delay would be estimated simultaneously by a structural system in which traffic depends on delay, and delay in turn depends on traffic. However, in the YVR study, traffic and delay were estimated by two separate models, with traffic estimated first without explicit reference to delay, and delay then computed on the basis of traffic. Two strategies were adopted to compensate for the absence of explicit consideration of the effects of delay in the traffic forecasting model. First, the effects of delay costs on traffic were modelled implicitly by adjusting aircraft size and load factor assumptions upward and hubbing ratios downward in the base case to simulate the response of airlines to capacity constrained conditions. Second, after forecast traffic had been used to calculate delays, the sensitivity of study results to capping traffic growth at a level that produced a "maximum tolerable delay" of 20 minutes per aircraft was investigated.

Forecasting of peak-period traffic under pricing and alternative airport development options was achieved by adjusting base-case traffic forecasts. The percent of base-case peak movements by aircraft type that would divert to off-peak periods under a peak fee was estimated based on the response to peak pricing at other airports. Under the alternative airport development option, the diversion attributed to a $100 peak fee was adjusted upward to allow for the increased attractiveness of alternate airports and the enhancement of surface transportation links. The increased attractiveness of alternate airports was analyzed in terms of the types of aircraft that they would be upgraded to handle and the importance to aircraft operators of hubbing on YVR.

To translate peak-period traffic into congestion delay requires simulating use of the capacity provided under each option by the traffic forecast for the option. This was achieved in the YVR study by use of ADSIM, a discreet-event (aircraft-by-aircraft) airfield simulation model developed by the U.S. Federal Aviation Administration and applied to YVR by Hickling Consultants in their study. The simulation model uses queuing theory to predict hourly flow rates and average arrival and departure delays, given data on traffic demand, runway configuration and air traffic control procedures. The model was tested by simulating arrivals and departures over three days in 1989 to determine the extent to which predicted hourly flow rates mirrored actual operations. In each case, simulated flow rates were within one percent of actual, providing confidence in the model as a planning tool.

Simulated delays for 1989, however, significantly exceeded delays recorded by YVR's delay monitoring program. This was attributed to deficiency in the delay monitoring system rather than to deficiency in the simulation model. In fact it seems that the data collected by YVR's delay monitoring program are compromised somewhat by the method of its collection. Control tower personnel record aircraft movements as they occur, but some movements (25.5 percent in 1988) are not recorded because of workload priorities in the control tower during peak periods.[26] Because peak periods are times of greater than average delay, YVR's delay monitoring program systematically underestimates the actual average level of delay.

Hence, although ultimately an integration of traffic demand and delay forecasting models would be desirable, the separate estimation of traffic demand and congestion delay conducted in the YVR study provides a credible basis for measuring the user benefits and costs of airport capacity expansion. Given credible demand forecasts, the existence of simulation models capable of translating demand into average delay, along with the existence of market prices at which to value delay time savings to aircraft operators and passengers, makes estimation of user benefits a fairly mechanical process.

Potentially more difficult to measure are the external costs imposed by airport development on non-users. The YVR study identified three areas of external cost associated with airport development — noise costs; effects on birds, other wildlife and their habitat; and air quality. The methodology used to measure noise costs in the YVR study follows established theory that defines the various components of the social welfare loss produced in a residential neighbourhood by an increase in noise. The first step in the methodology was to determine the number and value of dwellings that move into higher noise contours due to operation of a new runway. The second step was a survey of real estate agents and the literature to estimate by dwelling type and noise contour the percent of householders who would move due to increased noise (6% on average), the depreciation in property values due to increased noise (2% to 6%), and to estimate householder surplus (the value that householders place on a dwelling in excess of its market value; 130% on average). The natural migration rate of those who moved for reasons other than increased noise was also estimated.

An important distinction was drawn between those who would move because of noise and those who would move for other reasons. Both groups of movers would suffer depreciation losses; those who would move because of noise would also suffer a loss of householder surplus. Those who would stay would not suffer depreciation costs but rather noise annoyance costs. These noise annoyance costs must technically be less than the depreciation and householder surplus costs of moving; otherwise those who stayed would have moved. To be conservative, annual noise annoyance cost was estimated such that its present value equalled the present value of the sum of depreciation and householder surplus costs, under the assumption that the average householder would stay for six years on average after opening of the new runway. In addition, noise insulation costs were calculated for schools and hospitals, as well as moving costs of those who would move because of increased noise.

These various components of incremental noise cost were estimated for both runway expansion at YVR and capacity enhancement at Abbotsford International Airport for representative future years. After a given amount of time, all original residents were assumed to move away and noise costs to drop to zero since those who move in after the new runway was in place receive benefits from depreciated housing prices that offset noise nuisance costs.

Although the YVR study identified the existence of external costs other than noise, only noise costs were quantified. The rationale for not quantifying wildlife and air quality costs was that the net benefits of parallel runway construction were so large that they were unlikely to be offset by environmental costs. Although the Environmental Assessment Panel agreed that environmental costs would not outweigh the estimated net benefits, it did not accept the rationale for excluding them from the analysis:

> By so doing, the analysis implicitly undervalues environmental costs. The federal government's stated objective in the Green Plan is to incorporate environmental criteria into policy and decision-making processes. In this case that has not been done. . . . It is no longer acceptable to exclude these costs from economic analyses."[27]

As the Panel suggested, a reasonable shadow price for valuing wildlife losses is the cost of replacing lost habitat, either through purchase of compensatory habitat or implementation of conservation programs in remaining habitat.

### Findings

Exhibit 2 summarizes the findings of the benefit-cost study of the airside capacity enhancement options at Vancouver International Airport. As it indicates, $25 and $100 peak-period minimum landing fees were found to produce net present values of $0.9 billion and $2.1 billion respectively. This reflects underlying estimates that the fees would divert 3.8% and 17.3% of peak-period traffic, respectively.

With an NPV of $3.8 or $3.9 billion, a parallel runway of 8,000 or 9,940 feet was found to produce greater net benefits than a peak-period fee. The amounts by which the NPVs of runway options exceed the NPVs of $25 and $100 pricing options are indicated by the figures in the columns labelled (b) and (c). Both pricing options produce greater net benefits than construction of a shorter runway of 5,000 feet capable of handling limited aircraft types. The pricing options were found to be superior to alternate airport development as well, whether 50 percent or 100 percent of surface transportation infrastructure costs were allocated to the latter option. The finding that a $100 peak fee alone produces a greater NPV than a $100 peak fee plus alternate airport development reflects the high capital cost of surface transportation improvements. It also reflects the underlying assumption that alternate airport enhancement — and hence the peak fee imposed to encourage alternate airport use — would not be fully implemented until 2001.

Whereas peak pricing alone was found to be superior to alternative airport development, and construction of the longer runways alone was found to be superior to peak pricing alone, construction of a longer runway in combination with peak pricing was found to be superior to construction of a runway alone. This reflects the finding that construction of a runway alone would not totally eliminate congestion and delay, either immediately or over the entire study period (to the year 2018). In fact, with construction of a 9,940-foot runway, delay was forecast to reach 1988 levels again by 2005. Hence, with a parallel runway, implementation of peak-period pricing would yield positive incremental net benefits, although these net benefits would not be as great as those attributable to peak pricing alone.

The combination of investment and pricing with the greatest NPV was found to be construction of a 9,940-foot runway with either a $25 or $100 peak-period minimum landing fee. Although the $100 fee in combination with

Exhibit 2

## PRESENT VALUES OF BENEFITS AND COSTS OF ALTERNATIVE STRATEGIES (1988 $ MILLIONS)

| | Strategy 1 Base case | | Strategy 2 — Parallel runway | | | | | | | | | | | Strategy 3 Alternative airport | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2A – 5,000 ft. | | | 2B – 8,000 ft. | | | 2C– 9,940 ft. | | | 2D – 9,940 ft. & $25 fee | 2E 9,940 ft. & $100 fee | | |
| | 1B – $25 | 1C – $100 | (a) | (b) | (c) | (a) | (b) | (c) | (a) | (b) | (c) | | | 50% | 100% |
| **User benefits:** | | | | | | | | | | | | | | | |
| Air carriers | | | 367 | –62.9 | –597 | 1834 | 1381 | 860 | 1890 | 1435 | 908 | 1890 | 1890 | 817 | 817 |
| Passengers | | | 439 | –29.4 | –616 | 2021 | 1575 | 960 | 2136 | 1605 | 1023 | 2136 | 2136 | 878 | 878 |
| **Total** | | | **806** | **–92.3** | **–1213** | **3855** | **2956** | **1820** | **4026** | **3040** | **1931** | **4026** | **4026** | **1695** | **1695** |
| **Costs:** | | | | | | | | | | | | | | | |
| Capital | | | 19 | 19 | 19 | 35 | 35 | 35 | 48 | 48 | 48 | 48 | 48 | 1091 | 2143 |
| Operating | | | 9 | 9 | 9 | 15.5 | 15.5 | 15.5 | 19 | 19 | 19 | 19 | 19 | 341 | 667 |
| Sub-total | | | 28 | 28 | 28 | 50.5 | 50.5 | 50.5 | 67 | 67 | 67 | 67 | 67 | 1432 | 2810 |
| Noise | | | 34.7 | 34.7 | 34.7 | 43.4 | 43.4 | 43.4 | 43.4 | 43.4 | 43.4 | 43.4 | 43.4 | 10 | 10 |
| **Total** | | | **62.7** | **62.7** | **62.7** | **93.9** | **93.9** | **93.9** | **110.4** | **110.4** | **110.4** | **110.4** | **110.4** | **1442** | **2820** |
| Net present value | | | 734 | –164 | –1285 | 3761 | 2862 | 1726 | 3915 | 2929 | 1820 | 3915 | 3915 | 253 | –1124 |
| **Landing fee:** | | | | | | | | | | | | | | | |
| Benefits | 921 | 2140 | | | | | | | | | | 326 | 633 | | |
| Costs | 1.3 | 17 | | | | | | | | | | 1.3 | 17 | | |
| Net benefits | 919.7 | 2123 | | | | | | | | | | 324.7 | 616 | | |
| Net present value | 919.7 | 2123 | | | | | | | | | | 4240.6 | 4531.6 | | |

**Source:** Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (March 1990), p. iv.

**Notes:** The sub-strategies (a), (b) and (c) for Strategy 2 refer to a minimum peak-period landing fee of $0, $25 and $100, respectively, in the base case. The range for Strategy 3 reflects an allocation of either 50 or 100% of the surface transportation costs. The macroeconomic gains are $2,576 million with Strategy 2 and $211 million with Strategy 3.

a runway produced a greater NPV ($4.5 billion) than the $25 fee ($4.2 billion), the difference between these two amounts was found to be statistically insignificant. Therefore, the $25 fee in combination with the 9,940-foot runway was recommended, reflecting the low level of congestion that would prevail in early years. This was accompanied by the recommendation that the peak fee be reviewed with the intention of revising it upward in future.

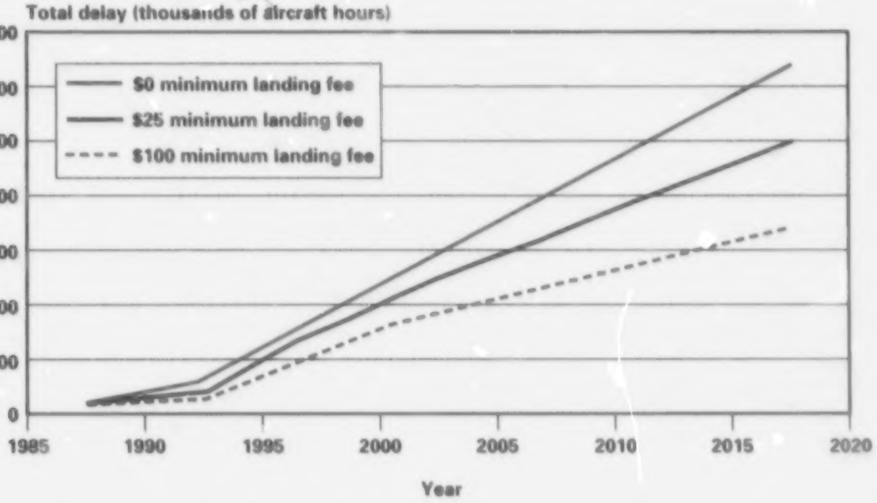
The benefits of all options had much more influence on their NPVs, and hence their rankings, than did the costs. For every option except alternative airport development, total benefits exceeded total costs by an order of magnitude. This is not to say that the costs are not large in absolute magnitude. The total cost of a parallel runway would be approximately $110 million, $43.4 million (39%) of which was attributed to increased noise. Of the noise costs, property depreciation comprised 37%, noise annoyance 30%, lost householder surplus 16%, moving costs 8%, and insulation costs 8%. Despite the large share of noise costs in total costs, and the large absolute magnitude of total costs, total costs were small relative to total benefits. For the recommended option, total benefits ($4.3 billion) exceeded total costs ($ 0.11 billion) by a factor of 39.[28] Only under the alternative airport development option did costs approach or exceed benefits, and in that case only as a result of the very high cost of constructing and operating a surface transportation link, estimated at $2.7 billion (1988 present value dollars).

Total annual delay forecasts are presented in Exhibit 3. Even with the combination of a 9,940-foot runway and a $25 peak-period minimum landing fee, delays are forecast to return to their 1988 levels by the year 2010. The finding that, even with a new runway and pricing measures, delays can be expected to re-emerge in the next century prompted the recommendation that steps be taken to preserve the option of future development of alternative airports in the Lower Mainland region.

The findings of the study are subject to uncertainties in the parameters that underlie all forecasting. As noted above, one of the principal uncertainties is that of predicting users' response to mounting delay in the absence of a parallel runway. The benefits of parallel runway construction were based on forecast delays that rise to 127 minutes per aircraft by the year 2018. If growth in traffic, and hence delay, were dampened before delays reached this point, either because passengers found them intolerable or because the airport imposed an administrative cap, then the benefits of parallel runway

Exhibit 3

## STRATEGY 1 — BASE CASE
## TOTAL ANNUAL DELAY, 1988–2018



## STRATEGY 2 — PARALLEL RUNWAY DEVELOPMENT
## TOTAL ANNUAL DELAY

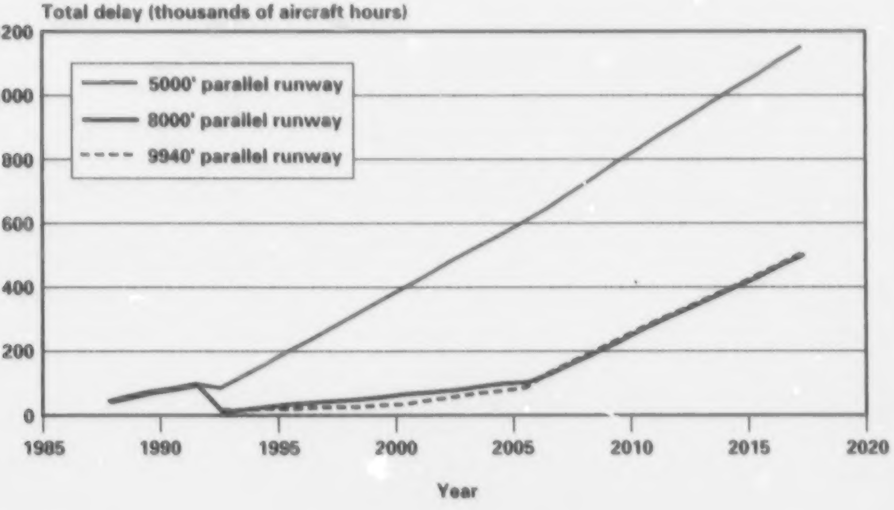
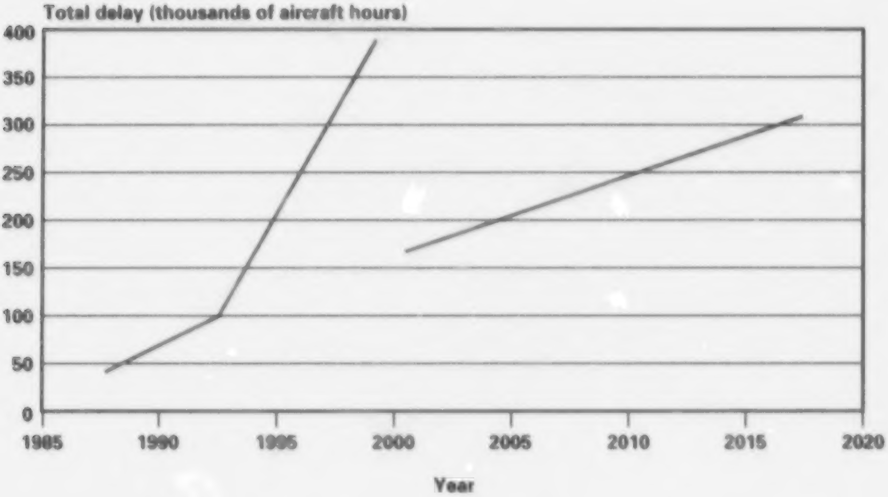


*Exhibit 3* (cont'd)

STRATEGY 3 — ALTERNATIVE AIRPORT DEVELOPMENT

TOTAL ANNUAL DELAY



**Source:** Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (March 1990), pp. 116, 118, 119.

construction would be smaller than those upon which the findings of the study were based. However, sensitivity analysis revealed that ranking of options would be unaltered, with a 9,940-foot runway continuing to yield a positive NPV (of $238 million), even under the extreme assumption that traffic would cease to grow when average delay exceeded 20 minutes.

The study also accounted for uncertainty in all underlying assumptions by assigning a subjective probability distribution to each assumption and then using Monte Carlo simulation techniques to derive a probability distribution for the NPV of each option. Monte Carlo simulation allows all underlying assumptions to vary from their expected values randomly and simultaneously and hence simulates the effect of real-world uncertainty on NPV. In this manner, an 80 percent confidence interval was constructed for the NPV of each option on the basis of 80 percent confidence intervals assigned to each underlying assumption by expert panels. This risk analysis lead to the conclusion that for the recommended option "while there is a risk of the net present value falling beneath the expected value of $3.9 billion, there is virtually no risk that it will be lower than $2.6 billion; a zero or negative net present value is associated with a zero probability."[29]

The YVR study found the first-year benefit ratio (FYBR) for a 9,940-foot runway to be 195%, well above the 10% discount rate, indicating a new runway to be far overdue in economic terms. The FYBR greater than 100% indicates that the runway produces net benefits in its first year of operation greater than its entire capital cost; this is confirmed by the payback period for the runway, reported in the study, of 0.44 years. Although not reported, the FYBR of the recommended option — a 9,940-foot runway plus a $25 peak-period minimum landing fee — would be slightly greater than 195% because the addition of pricing was found to produce small incremental benefits from further reductions in congestion in the first year of operation of the new runway.[30]

From its FYBR it is possible to calculate the annual cost of overdue runway expansion at YVR. By definition, the product of the FYBR (1.95) and the present value of the capital cost of a parallel runway ($48 million) gives the present value of the net benefit generated by the runway in its first year of operation ($93.6 million). The cost associated with overdue runway construction, as measured by the cost of postponing runway implementation by one more year, is the present-valued delay savings foregone in that year ($93.6 million) less the opportunity cost of capital saved by postponing implementation (0.1 × $48 million). The cost of overdue runway construction at YVR is therefore approximately $88 million per year.

The optimal timing of runway construction has to be examined in relation to peak-period pricing as well. This can be determined by calculating a FYBR using the first-year benefit of a runway given that pricing is already in place. This "incremental" first-year benefit of runway construction is the first-year benefit of the (runway plus pricing) combination less the first-year benefit of pricing alone. The YVR study reported a FYBR of 82% for construction of a 9,940-foot runway "with a $100 minimum landing fee in the base case."[31] Since the FYBR of 82% far exceeds the discount rate of 10%, runway construction at YVR would be overdue even if a $100 peak-period minimum landing fee were in place.[32] Hence, the findings of the study indicate that even with peak-period pricing, sufficient congestion delay costs would exist in 1993 (the assumed year of commissioning of the runway) to outweigh the interest savings on capital that could be achieved by postponing construction by one year. The need for runway construction at YVR is overdue not only because of a lack of peak-period pricing but also because of a lack of physical capacity.

## 3.3 LESTER B. PEARSON INTERNATIONAL AIRPORT[33]

### Scope

Similar to the case for runway expansion at Vancouver International Airport, substantial congestion delays at Pearson suggested the potential need for runway expansion there as well. Between 1984 and 1988, there was a 33 percent increase in passenger volumes and a 40 percent increase in number of aircraft movements per day at Pearson. This rapid growth in traffic stemmed both from buoyant economic conditions in Southern Ontario and from the emergence of Pearson as Canada's primary hub for domestic, transborder and international flights.

The growth in traffic strained existing airport capacity and resulted in increasing delays beginning in 1987. In response, the Minister of Transport introduced an aircraft reservation system and put in place a cap on aircraft traffic of 70 movements per hour. Increased air traffic control staffing led to an increase in the cap to 76 movements per hour in 1990.

At the same time, measures for increasing the efficiency of use of the existing airside infrastructure at Pearson were investigated. These measures included improvements to both infrastructure and operations to maximize the capacity of the existing airfield. These changes were expected to increase the hourly capacity of the existing runways to 96 movements per hour. Using peak-period pricing to shift movements to off-peak hours was found to be largely ineffective due to the fairly inelastic demand of most users of the airport. Despite their limited potential impact on delay, however, minimum landing fees are being introduced at Pearson.

With these improvements to existing airside capacity, traffic demand could be expected to reach 96 movements per hour within five years, leading to the re-emergence of severe congestion problems or the need to impose further caps on use. These findings led to the conclusion that Pearson needed runway expansion.

The base case for the benefit-cost study of runway expansion options at Pearson included all measures required to optimize the capacity of existing runways. These improvements included new taxiways, runway entries/exits, air navigation technologies and procedures, and full staffing of the air traffic control system. Peak-period pricing was not included in the base case, but it was assumed that the cap on runway movements would remain in place along with an administrative allocation system for shifting traffic from peak times to shoulder times and off-peak times.

The existing three-runway configuration at Pearson consists of two east-west (06-24 direction) parallel runways, and one north-south (15-33 direction) runway. The parallel 06-24 runways handle most traffic, but five percent of the time wind conditions prevent use of the 06-24 runways, limiting airport capacity to the single 15-33 runway. The benefit-cost study of runway expansion considered nine options for additional runways. Three options specified a single additional runway in the 06-24 direction, two options specified two additional 06-24 runways, three options specified a single additional 15-33 runway, and one option specified two additional 06-24 runways plus one additional 15-33 runway. The development of alternate airports was not considered because the five other airports in the vicinity of Toronto each face physical (ground or airspace) or institutional constraints that make their expansion infeasible.

The types of user benefits to 06-24 runway construction examined in the Pearson study mirrored those examined in the Vancouver study, and included delay cost savings to base-case traffic and consumer surplus gains to traffic generated by the new runways in excess of base-case traffic. The types of user benefits that were considered for construction of a 15-33 runway were more extensive. Such construction would not only alleviate delays caused by traffic growth but also the flight diversions and cancellations that are currently required during times when wind conditions prevent use of the 06-24 runways. Reduction of these disruption costs was the primary rationale for considering construction of a new runway in the 15-33 direction. Macroeconomic benefits were not included in the benefit-cost study, but were documented in a separate study.[34]

### Approach

To measure the benefits of runway expansion — both delay savings to base-case users and consumer surplus benefits to generated users —

requires estimates of the reduction in average delay time and the increase in traffic volume induced by new runways. These estimates in turn require forecasting of traffic under base-case and runway expansion conditions, and conversion of these traffic forecasts into average delay times under base- case and runway expansion capacities.

As noted in our discussion of the Vancouver benefit-cost study, one challenge in forecasting traffic is to model the effect of congestion delay on traffic growth. In the Vancouver study two approaches to this problem were attempted. Base-case traffic forecasts of aircraft movements were adjusted downward to reflect the use of larger aircraft with higher load factors by airlines in response to rising delay. Yet even with this adjustment, average delay was forecast to rise to high levels in the absence of a new runway, reaching 128 minutes by the year 2018. To account for the possibility that traffic growth would be severely inhibited by delay before delay reached such high levels, a sensitivity analysis assessed the effects of capping traffic growth when average delay reached 20 minutes. The effect of both attempts to model the effect of delay on traffic growth was to decrease the delay savings benefit of runway construction, but to increase generated user benefits to runway construction, by creating a gap between base-case and runway expansion traffic forecasts.

In the Pearson benefit-cost study, a more stringent approach was taken to modelling the effects of delay on traffic growth than in the Vancouver study. The Pearson study assumed that, in the absence of runway construction, the airport authority would intervene to cap the hourly flow of aircraft before delay reached high levels. The study assumed not only that base-case traffic would be capped at 96 movements per hour, but also that an administrative allocation system would be in place to shift traffic demand from peak to off-peak or shoulder times. These assumptions were reflected in two traffic forecasts: a role-related forecast applied to the runway expansion options and a constrained forecast applied to the base case. The role-related traffic forecast was based on air travel demand forecasts unconstrained by delay. The constrained forecast allocated role-related traffic across peak and off-peak (or shoulder) times under the constraint that hourly traffic not exceed 96 movements per hour. In this manner all role-related ATB (air terminal building) and cargo movements were accommodated in the constrained forecast. Some GA (general aviation) movements which represented the traffic generated by runway expansion, were not accommodated in the constrained forecast.

The two traffic forecasts were presented by planning day schedules for the years 1996, 2001 and 2011 that represent the averaged hourly aircraft movements of the seven busiest days in each of the three busiest months of a year. Exhibit 4 illustrates the planning day schedules forecast for the year 2011, and demonstrates how constrained traffic schedules were derived by spreading peak-period traffic over off-peak and shoulder times.

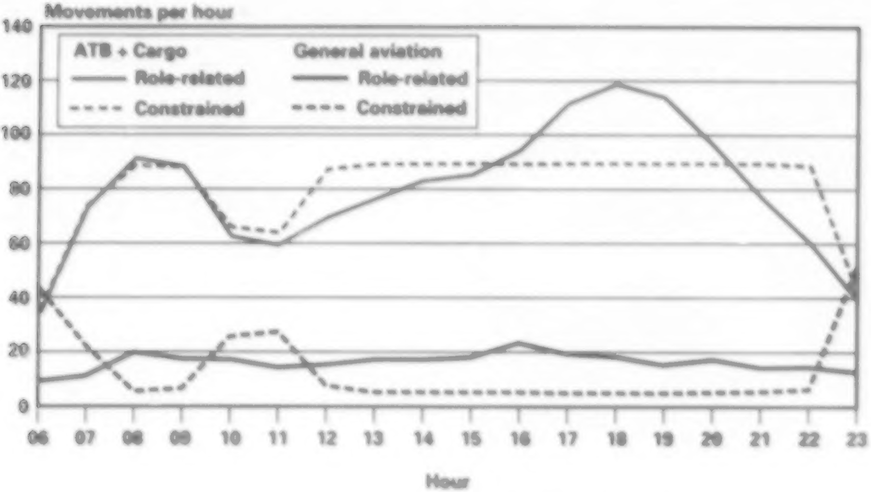
The Pearson study arrived at more conservative estimates of the benefits of runway expansion than did the Vancouver study. In the Pearson study, average delay in the base case was limited to that produced when the existing runways are operating at their maximum hourly capacity (96 movements per hour). This contrasts with the Vancouver study, which allowed hourly traffic demand to increase above maximum hourly capacity until average delay mounted to a maximum tolerable level. The result is that the administrative allocation approach assumed in the Pearson study led to less delay in the base case, and hence fewer delay savings to runway expansion than did the "maximum tolerable delay" approach assumed in the Vancouver study. The administrative allocation assumption also produced less generated user benefits than the "maximum tolerable delay" assumption since, by allocating some peak-period traffic to off-peak periods, it accommodated almost all role-related traffic movements.[35]

Hence the Pearson study, by assuming greater intervention on the part of the airport authority to limit delay in the absence of runway expansion, took a more conservative approach to estimating the benefits of runway expansion than did the Vancouver study. It could be argued that the Vancouver study also allowed for shifting of some users from peak to off-peak times by considering the implementation of a peak-period minimum landing fee. However, this peak fee resulted in a less extensive shifting of traffic away from peak times than did the administrative allocation response to congestion assumed in the Pearson study.[36]

Although the assumptions underlying their base-case traffic forecasts differ, the Vancouver and Pearson studies used the same method to convert base-case and expansion-option traffic forecasts into average delay times. As in the Vancouver study, the Pearson study used a discrete simulation model of airfield operations to predict the average delay times that would occur under the traffic forecasts and capacity conditions specified in the base-case and runway expansion options. The constrained planning day schedules were

*Exhibit 4*

*2011 Planning Day Schedules*



Source: Transport Canada, *Toronto Lester B. Pearson International Airport Airside Development Project, Final Report No. 24, Benefit/Cost Analysis*, TP10854E, April 1991, p. 43.

simulated in conjunction with base-case capacity, and the role-related planning day schedules were simulated in conjunction with each runway option capacity. Average aircraft movement delay was converted into average passenger delay by making assumptions about the distribution of aircraft types and load factors. Aircraft delays were then valued using aircraft operating costs, and passenger delays using a value for passenger time. The value of passenger time was constructed as a weighted average of the value of business and leisure travel time. As in the Vancouver study, the average wage rate of business travellers was used as an approximation of the market's valuation of an hour of work time, and leisure time was valued at 40 percent of the value of work time. This resulted in a weighted average value of passenger time of $26.33 per passenger-hour, expressed in 1990 dollars.

The average delay costs produced as such represented planning day delay costs for 1996, 2001 and 2011. To produce an estimate of annual delay costs, the planning day delay costs were used to estimate an average delay cost function using a queuing theory specification that describes the exponential relationship between runway movements (in this case movements per day) and average delay cost. This average delay cost function was then applied to frequency distributions of base-year and forecast-year daily movements to obtain estimates of annual delay costs for the base case and each runway expansion option.

The types of benefits estimated for 15-33 (north-south) runway expansion were more extensive than the delay savings and resulting consumer surplus benefits estimated for 06-24 (east-west) runway expansion options. This reflected the role of an additional 15-33 runway in reducing the cost of disruptions that occur when wind conditions prevent use of the 06-24 runways. Without the 06-24 runways, capacity is currently limited to the single 15-33 runway; the result is sudden and severe congestion. Depending on the time and duration of such weather-induced disruptions, a large number of flights can be delayed on the ground, in the air on approach to Pearson, or on the ground at other airports. Some flights may be diverted or cancelled.

Estimation of the benefits of a second 15-33 runway was conducted by simulating the effects of a representative "weather incident" on forecast planning day schedules. The disruption costs of this representative incident were simulated with and without a second 15-33 runway, both in the presence of and absence of an additional 06-24 runway. The presence of additional 06-24 runway capacity affects disruption costs by affecting both the magnitude of forecast traffic and the size of the queue that is allowed to accumulate during the disruption. Disruption costs under each runway scenario were then converted to annual disruption costs based on historical data indicating the number of hours of weather-mandated 15-33 runway use over one year.

Simulation of a disruption incorporated the capacity rationing rules currently used during such incidents that give priority to larger aircraft and longer flights; general aviation movements are cancelled or diverted to other airports. The costs of cancellation, diversion, overflight and delay were calculated on the basis of a model developed by Transport Canada for the evaluation of approach aids.[37] Delay costs were estimated on the basis of average queue length, with all departure delays assumed to be taken on the ground, one third of arrival delays assumed to be taken in the air and the balance taken on the ground at another airport. Passenger cancellation costs include delay time, additional handling costs and the foregone benefits of travelling for passengers who do not reschedule, the latter estimated conservatively to be the amount of their fares. For aircraft, the cost of cancellation is that associated with repositioning. Diversion costs are the extra flight time and ground transport costs associated with diverting general aviation and piston aircraft to nearby airports. Overflight costs are cancellation costs to Pearson-bound passengers who do not board aircraft that plan to overfly Pearson to go to their next destination.

As in the Vancouver study, depreciation in property values provided a basis for valuing increased noise costs. An empirical relationship between noise and property values was established through hedonic regression techniques which regressed housing sale prices on a range of housing characteristics plus a measure of noise exposure, NEF, for a sample of more than 3,000 observations within an eight-mile radius of Pearson. Dwelling market price data by enumeration area were obtained from Census and MLS data, along with the natural rate of emigration. The relationship between increased noise and increased moves out of the area was determined by estimating a dose-response function between those who reported being "highly annoyed" by noise and NEF levels.

Given these relationships between noise levels, property values and natural and noise-induced migration, the study calculated property depreciation, moving, householder surplus and increased noise nuisance costs. Property depreciation is a factor for all those who move, either naturally or induced by increased noise. Moving costs were attributed only to those who moved because of noise. Noise-induced movers also suffer consumer surplus losses stemming from their attachment to the community or their home. These losses were estimated by the difference between the subjective value of a dwelling and its market value, obtained by comparing valuations reported in Census data and MLS data. Increased noise nuisance costs apply to residents who remain in the area, and were estimated to be equal to imputed property depreciation. New residents moving into the area were assumed not to be affected by noise since the associated costs would already be capitalized in the depreciated price they paid for the property. Thus noise nuisance costs were assumed to diminish over time.

Environmental costs other than noise, such as loss of terrestrial and aquatic habitat, were not quantified, but were considered in choosing between 15-33 runway options with marginally differing NPVs, as described below.

## Findings

Exhibit 5 presents forecast traffic and simulated average delay under the base case and the 06-24 runway expansion options. The base case includes nearly all traffic accommodated under runway expansion; generated user benefits from 06-24 runway expansion are therefore minimal. However, the delay savings induced by 06-24 runway expansion are substantial; runway expansion would reduce average delay cost compared to the base case, even in the first year of operation. One additional runway would reduce average delay by more than half; two additional runways would reduce average delay to near zero for the entire study period.

Exhibit 6 compares the present value benefits of 06-24 runway expansion options with their present value capital and operating costs. Noise costs are assessed at a later stage of the analysis and shown not to affect the results (see below). The figure demonstrates that while the costs of 06-24 runway expansion are large (in the range of $200 million per runway), the delay savings benefits are larger still, with all runway expansion options producing large positive NPVs. The recommended option specifies construction of two additional 06-24 runways at a present value cost of $354 million, and yields benefits of $1.3 billion for a NPV of $990 million.

This finding is consistent with those of the Vancouver study, the recommended option of which produced user benefits of $4.0 billion. That an approximate doubling of main runway capacity at Vancouver was estimated to produce user benefits three times those estimated for an approximate doubling of runway capacity at Pearson may reflect the more conservative benefit estimation technique used in the Pearson study.

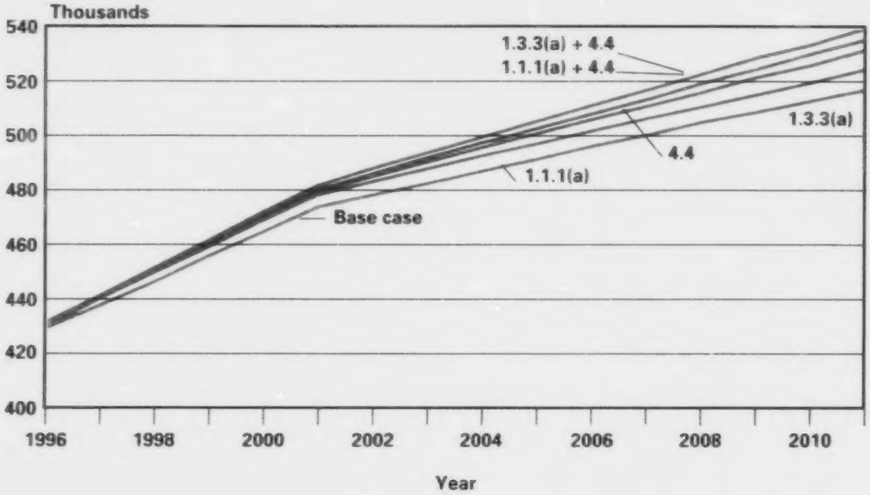
Not only were the estimated benefits of runway expansion higher at Vancouver, but the capital costs were lower, leading to much higher benefit-cost ratios for the recommended option at Vancouver (17.4) than at Pearson (3.8) and, also, much higher internal rates of return (76% versus 30%).

Exhibit 6 also compares the disruption reduction benefits of 15-33 runway options to their capital and operating costs. The benefits of an additional 15-33 runway are apparently not affected by the presence or absence of additional 06-24 runways. For both existing and expanded 06-24 runways, the two longer 15-33 runway options produce large positive NPVs.

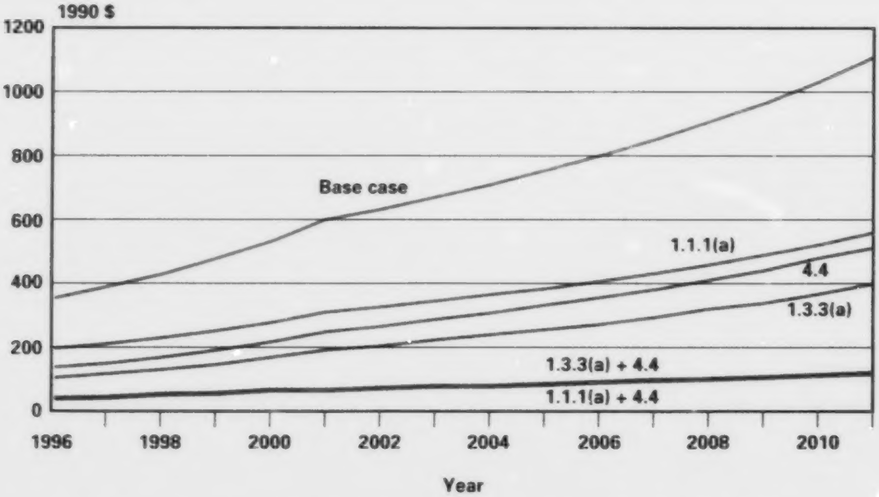
*Exhibit 5*

### DELAY AND TRAFFIC IMPACTS OF RUNWAY OPTIONS

A) ANNUAL MOVEMENTS



B) AVERAGE DELAY COST PER MOVEMENT



**Source:** Transport Canada, *Toronto Lester B. Pearson International Airport Airside Development Project, Final Report No. 24, Benefit/Cost Analysis*, TP10854E, April 1991, p. 65.

Exhibit 6

## BENEFIT-COST ANALYSIS: RESULTS SUMMARY
## (PRESENT VALUE — MILLIONS OF 1990 $)

**a) 06-24 Runway Options**

| | Option | | | | |
|---|---|---|---|---|---|
| | 4.4 | 1.1.1(a) | 1.3.3(a) | 1.1.1(a) +4.4 | 1.3.3(a) +4.4 |
| **Benefits** | | | | | |
| to existing users | 854.8 | 712.1 | 937.6 | 1,329.2 | 1,244.3 |
| to new users | 6.8 | 3.6 | 8.8 | 15.1 | 15.0 |
| **Total** | **861.6** | **715.7** | **946.4** | **1,344.3** | **1,259.3** |
| **Costs** | | | | | |
| Capital | 181.0 | 146.4 | 206.5 | 326.7 | 386.3 |
| O&M | 14.2 | 12.6 | 11.2 | 26.8 | 23.8 |
| **Total** | **195.2** | **159.0** | **217.7** | **353.5** | **410.1** |
| **Net benefits** (benefits less costs) | 666.2 | 556.7 | 728.7 | 990.6 | 849.1 |
| **Benefit-cost ratio** | 4.41 | 4.50 | 4.35 | 3.80 | 3.07 |
| **Internal rate of return %** | 33.6 | 32.5 | 30.7 | 29.8 | 24.6 |

**b) 15-33 Runway Options**

| | Option | | | | | |
|---|---|---|---|---|---|---|
| | 2.1.4 | | 3.1.2 | | 3.2.1 | |
| | **Existing 06-24** | **Expanded 06-24** | **Existing 06-24** | **Expanded 06-24** | **Existing 06-24** | **Expanded 06-24** |
| **Benefits** Reduced disruption | 159.5 | 163.7 | 279.4 | 274.1 | 395.4 | 410.3 |
| **Costs** | | | | | | |
| Capital | 149.0 | 149.0 | 157.2 | 156.8 | 257.6 | 257.6 |
| O&M | 13.1 | 13.1 | 11.7 | 11.7 | 19.4 | 19.4 |
| **Total** | **162.1** | **162.1** | **168.9** | **168.5** | **277.0** | **277.0** |
| **Net benefits** (benefits less costs) | (2.6) | 1.6 | 110.6 | 105.6 | 118.4 | 133.3 |
| **Benefit-cost ratio** | 0.98 | 1.01 | 1.66 | 1.63 | 1.43 | 1.48 |
| **Internal rate of return %** | 9.8 | 10.1 | 16.4 | 16.1 | 14.6 | 15.3 |

**Source: Transport Canada, *Toronto Lester B. Pearson International Airport Airside Development Project, Final Report No. 24 Benefit/Cost Analysis*, TP10854E, April 1991, pp. 69, 103.**

Although these NPVs are not as large as those obtained for the 06-24 runway options, they nonetheless provide justification for construction of a 15-33 runway. The 15-33 option with the greatest NPV, option 3.2.1, was not recommended, however, due to environmental considerations that had not been quantified. Option 3.2.1 would require extensive fill within the Etobicoke/Spring Creek ravine, resulting in a much higher loss of terrestrial and aquatic habitat than would Option 3.1.2. Option 3.2.1 would also expose new areas to noise while Option 3.1.2. would not. For these reasons, the option with the second highest NPV, Option 3.1.2, was recommended. The choice of Option 3.1.2 over Option 3.2.1 leads to a loss in NPV, and an implicit valuation of environmental costs of approximately $30 million.

Noise costs were modelled for the recommended 06-24 and 15-33 runway options. Noise nuisance cost to remaining householders was found to be the largest noise cost component, accounting for approximately 65% of total noise cost. Total incremental noise cost amounted to only $5.1 million for the addition of an 06-24 runway and was negligible for the addition of a 15-33 runway. The inclusion of noise costs in the benefit-cost analysis had an insignificant effect on benefit-cost results, reducing the NPV of the recommended 06-24 option by only 0.5%. Variation in the cutoff level of noise exposure indicated noise costs to be two orders of magnitude less than the net benefits of runway expansion, regardless of the noise cutoff used.

Sensitivity analysis was performed to test the impacts of changes in many key assumptions underlying forecasts of 06-24 and 15-33 runway benefits and noise costs. Variation of model parameters within reasonable limits was found not to affect study results. Reasonable reductions in aircraft operating costs or the value of passenger time were shown to have no significant effect on the economic attractiveness of the preferred options; even if no value were attached to passenger time, the NPVs of the preferred options would be positive. For the 06-24 option, a cap on base-case traffic growth at 1996 levels was also investigated as an extreme reaction to delay; even under this assumption, sufficient delay cost savings would exist to justify two additional 06-24 runways. In the case of 15-33 runway expansion, the key variable was the amount of time during which weather conditions confine traffic to the 15-33 runways. A study of weather data indicated that such conditions occur 4.7% of the time. However, an additional 15-33 runway was shown to break even if only needed 2.9% of the time.

Delaying implementation of the recommended 06-24 runway option by one year was found to decrease its NPV by $40 million. This large cost of delaying runway implementation is consistent with the $45 million cost of a one-year delay calculated above for Vancouver and reflects the high cost incurred in running a congested airport. A first-year benefit ratio (FYBR) for the recommended Pearson runway expansion options can be calculated by dividing the (present-valued) first-year net benefit by the (present-valued) capital cost of expansion. For the recommended 06-24 runway option this yields a FYBR of 23.2% (76/327). This FYBR greater than the discount rate (10%) indicates that 06-24 runway expansion is overdue, although not as overdue as runway expansion at Vancouver, with a FYBR of 82%. Inclusion of administrative allocation in the base case of the Pearson study ensures that 06-24 runway expansion is overdue because of a lack of capacity, not a lack of use of existing capacity. The FYBR for the recommended 15-33 runway option is 11.2% (17.5/156.8), indicating that current timing of 15-33 runway expansion is close to optimal.

## 4. THE AIRPORT PRICING PROBLEM

Having discussed the conditions governing the efficient level of capacity, we now turn to the question of the efficient use of a given level of capacity. The following section presents the theoretical solution to this short-run planning problem and a translation of that solution into requirements for an efficient short-run utilization policy. Several short-run policies are evaluated according to their ability to meet efficiency requirements ranging from administrative allocation to social marginal cost pricing. Finally, we review the current pricing practices at Canadian airports and evaluate the proposed cost-recovery policies of Transport Canada from the standpoint of economic efficiency.

### 4.1 THEORETICAL PRINCIPLES

Given a fixed level of capacity, airport planners must find the solution to two problems: determining the level of use of the fixed capacity, and allocating this level of utilization among users. Efficient use and allocation are determined by the trade-off between users' valuations of using the facility and the social cost of usage.

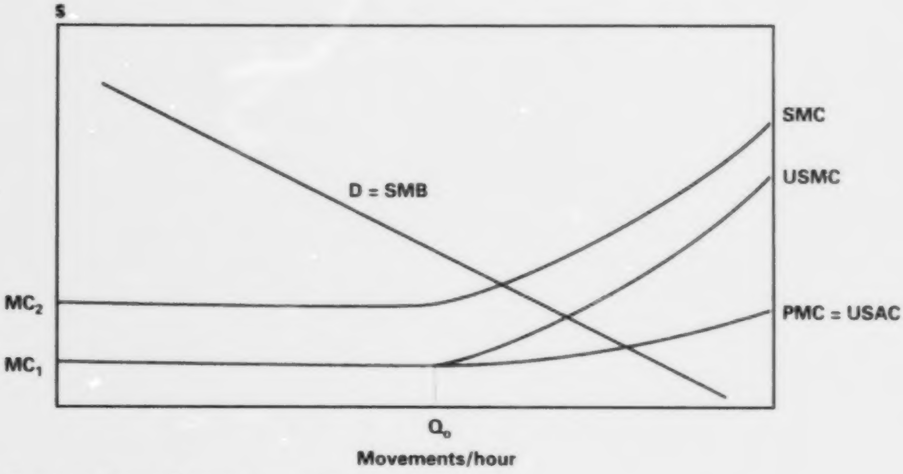
Exhibit 7 illustrates the short-run planning problem. For some fixed facility size, the x-axis indicates the level of utilization in movements per hour. The demand curve (D) represents aircraft operators' demand for usage of the facility and is derived from the demand for air transportation.[38] The demand curve plots users' valuations of using the facility (their willingness to pay for usage) in descending order. The demand curve is therefore the marginal valuation curve of users as a group: for any level of use the demand curve indicates the valuation of the marginal user (the user who values facility usage least) under the assumption that facility usage is allocated to users in the order of their valuations, with the user who values usage of the facility most (the "high-valued" user) allocated usage first. As use increases, the valuation of the marginal user falls and, hence, the demand curve slopes downward. Assuming that users are the only beneficiaries of airport use,[39] the demand curve is not only the users' marginal valuation curve but also the social marginal benefit (SMB) curve: at each level of facility use, the demand curve plots the benefit to society of increasing use by a small increment.

We now turn from the social marginal benefits of expanding facility use to the social marginal costs. The costs relevant to determining the efficient use of fixed airport resources are all social costs that vary with airport usage, including aircraft operating costs, passenger-time costs, airport operation costs and externality costs (such as noise costs). When considering marginal user costs, it is important to distinguish between costs that are borne by the marginal user and costs that the marginal user imposes on other users. The former are termed private marginal costs (PMC) and the latter, which arise from the increased congestion that an additional user imposes on all other users, are termed marginal congestion costs. The sum of private marginal cost and marginal congestion cost is termed users' social marginal cost (USMC), where "social" in this case denotes costs borne by all users.

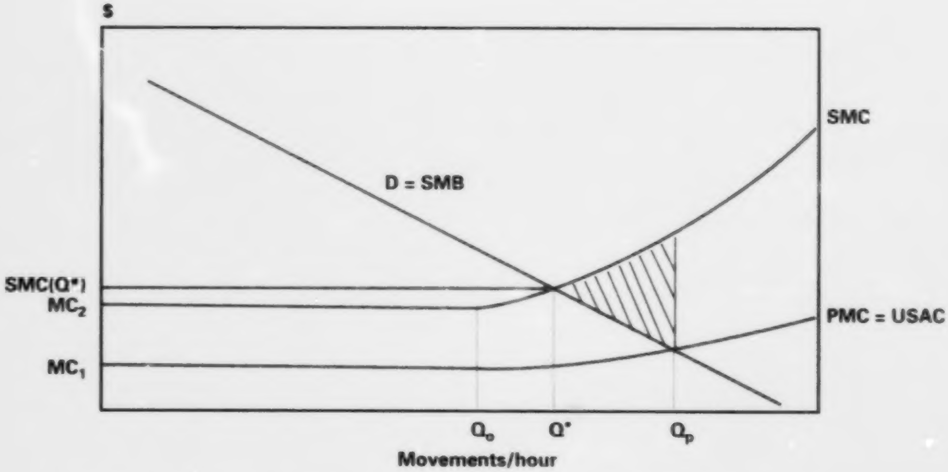
As use is expanded from zero to $Q_0$ there is no congestion and the private marginal cost (PMC) is constant at $MC_1$ (see Exhibit 7). All users are able to pass through the facility at the maximum speed technologically possible, making the private cost of operating an additional aircraft the same as that of operating all previous aircraft.[40] Since PMC is constant, $MC_1$ also equals users' social average cost (USAC) in the absence of congestion. When use expands beyond $Q_0$ movements per hour, the facility becomes congested, and the magnitude of congestion increases as the number of movements per hour increases.

*Exhibit 7*

SOCIAL MARGINAL BENEFITS AND COSTS OF FACILITY USE



SOCIAL AND PRIVATE OPTIMUM UTILIZATION LEVELS



Congestion affects all users equally: for a given level of utilization, all users experience the same level of congestion. The congestion cost borne by each user, when added to users' average operating cost without congestion ($MC_1$), is termed users' social average cost (USAC). Since the marginal user bears the same congestion cost as each other user, PMC equals USAC. Also, seeing that marginal users bear only the average, not the total, increase in delay cost resulting from their usage, PMC is less than the cost to all users of marginal usage (USMC). If marginal users were to withdraw from the facility, the cost savings would include not only the operating and congestion costs borne by marginal users (USAC) but also the congestion cost that marginal users impose on all other users. Under congested conditions, the full cost to users of a marginal increase in use (USMC) is therefore greater than the cost to marginal users (PMC) and, hence, the USMC curve lies above the PMC curve over the congested range of use greater than $Q_0$, and coincides with PMC for use less than $Q_0$.

The concept of social marginal cost of expanding use can be widened to include costs that vary with use other than those directly borne by users. These non-user marginal costs include marginal airport operation costs (such as air traffic control and runway resurfacing) and marginal externality costs (such as noise costs). These costs to non-users of marginally increasing facility use are assumed to be constant at all levels of utilization and equal to $MC_2 - MC_1$ in Exhibit 7. The social marginal cost (SMC) curve is obtained by shifting the users' social marginal cost (USMC) curve upward by an amount equal to $MC_2 - MC_1$. The SMC curve plots the full social cost of increasing facility use by one movement per hour at each level of utilization; this social marginal cost includes the operating and passenger time costs of marginal users, the marginal congestion cost imposed by marginal users on all other users, the marginal airport operating cost of serving marginal users, and the marginal noise and other externality costs imposed by marginal users.

The efficient level and allocation of facility use are determined by the facility's social marginal cost (SMC) curve and social marginal benefit (demand) curve. The efficient level and allocation of use is that which maximizes net social benefits. Net social benefits are maximized when use is maximized subject to the constraint that no user value usage of the facility less than the facility's social marginal cost. This constraint is satisfied when marginal users (those who value usage least) value usage no less than the social marginal cost of serving them. Maximizing use subject to this constraint means expanding use in a manner that allocates usage to users in order of their valuations until the marginal users' valuation (and hence the SMB) equals the social marginal cost. Graphically, this solution is also represented in Exhibit 7 by the intersection of the demand curve with the SMC curve at utilization level $Q^*$ and social marginal cost level $SMC(Q^*)$.

Note that congestion is not eliminated at the efficient level of facility use, $Q^*$. The objective of maximizing net social benefits does not imply eliminating congestion, but rather expanding facility use until the social marginal cost of expansion (which is driven upward by increased congestion) exceeds the valuation of marginal users. Hence, the efficient level of use is not the no-congestion level, $Q_0$, but rather $Q^*$, which represents the optimal level of congestion. Note also that the efficient level of use, $Q^*$, is not the level of use that would arise in the absence of intervention by the airport authority.

New users have an incentive to enter the facility as long as their marginal valuations of usage exceed their private marginal costs. Hence, in the absence of regulation, facility use would expand beyond its socially optimal level to the private equilibrium level, $Q_p$. At $Q_p$ social marginal cost exceeds social marginal benefit by a wide margin; the magnitude of the welfare loss (the loss of NSB) of operating at $Q_p$ rather than at $Q_o$ is depicted by the shaded area in Exhibit 7. This welfare loss under unregulated conditions represents a "market failure" that results from the significant external costs (particularly congestion) that are generated by use of the facility that are not borne by users. Attainment of socially optimum facility use requires intervention by the airport authority, either through utilization restrictions or through utilization pricing that shifts the social marginal cost of utilization to the users.

The optimal short-run policy is one that uses the facility at the flow rate of $Q^*$ and restricts use to users who value usage greater than $SMC(Q^*)$. In procedural terms, the implementation of such a policy requires the following steps:

- Allocate usage of the facility to users in order of their valuation of usage, giving priority to high-valued users.
- Continue to expand usage until the valuation of the next prospective user is less than the social marginal cost of expanding usage.

The first step requires that use of the facility be rationed efficiently among users, regardless of the overall level of utilization. The second step requires that the level of utilization be the efficient level, where the marginal valuation of usage equals the social marginal cost of usage.

## 4.2 CAPACITY ALLOCATION OPTIONS

### Administrative Allocation

A common method of managing fixed airport capacity is through the use of traffic quotas set by airport authorities. Typically, a scheduling committee made up of individual airlines allocates the pre-set traffic quota among carriers in the form of slots and timetables which jointly satisfy the traffic quota.[41] This quota/slot allocation method has been used at a number of major Canadian and American airports, as well as at many airports in Europe and Asia.

Whether such an administrative method of allocating use can ration a traffic quota efficiently (giving priority to high-valued users) is open to question. A fundamental obstacle to efficient allocation is the inability of the airport authority to know the valuations of potential users of the facility and, hence, the inability unilaterally to allocate the quota in a manner that gives priority to those users who value usage the most. Incentive problems preclude the airport authority from simply asking each user his or her valuation since each user has an incentive to over-report in an attempt to receive a larger allocation. Rules for estimating the valuations of individual users are also fallible. For example,

> under the current scheduling committee system it is quite possible to prescribe a rule under which a charter jet, filled with tourists who are indifferent between landing at 5:00 pm or 8:00 pm, obtains a 5:00 pm peak hour slot, while a CEO of a large local company, travelling by small private aircraft, has his/her flight delayed for three hours, thus missing an opportunity to close a deal which would have brought substantial employment to the community. Although this person may have valued the 5:00 pm landing slot higher than the charter flight, a scheduling committee has no way of telling that.[42]

A more pervasive problem results from low-valued, general aviation flights delaying large, high-valued commercial flights. Inefficient quota allocation occurs because there are usually separate traffic quotas for general aviation and commercial traffic, and the slots for general aviation operations are allocated on a first-come-first-served reservation basis. Under such a system, general aviation flights are allocated slots in a manner that does not take account of their valuations of those slots in comparison to other general aviation flights, nor in comparison to commercial flights.

Assuming that some mechanism can be found to incorporate general aviation into the slot allocation system in such a manner that slots can be allocated to all flights — general aviation or commercial — on the basis of their valuations, there remains the problem of designing an administrative allocation system that can identify and assign priority to high-valued users. Since users will not reveal their valuations without sufficient incentive, such an allocation must place users in a situation which induces low-valued users to reveal their low valuations through their willingness to be compensated for relinquishing their claims to slots. Conversely, high-valued users can be identified by their willingness to pay for slots. Hence, in general, users can be induced to allocate a traffic quota efficiently among themselves through a competitive mechanism which requires high-valued users to compensate low-valued users for the right to use peak-period slots.

It can be argued that the bargaining process inherent in a scheduling committee allocation system is a competitive mechanism that can achieve an efficient allocation of a traffic quota. The competitive nature of the bargaining process requires each airline to make concessions with respect to the number of flights that it will operate during peak periods. Each airline will concede its low-valued flights in order to retain its high-valued flights. Under certain conditions, such a bargaining process is likely to produce an efficient allocation of the traffic quota. The conditions are that the number of airlines be small, their valuation distributions similar, and each airline know the cost and demand conditions of the others.[43] As the number of airlines increases and airlines with differing valuations are introduced, the outcome of the bargaining process becomes less predictable, and it is uncertain whether a bargaining process alone will reach the efficient allocation. However, assuming that the airlines are able to make side payments (pay monetary compensation to each other), the traffic quota is likely to be allocated efficiently.

In addition to the requirement for efficient allocation, efficient use of fixed capacity requires that the quota itself be set at the efficient level, so that the social marginal benefit and social marginal cost of facility use are equal. As the discussion of bargaining has indicated, it may be possible for the airport authority, without knowing users' valuations of airport usage, to design an administrative mechanism that rations a given traffic quota efficiently. It is, however, impossible for the airport authority to ensure that the quota is set at the efficient level without knowing the valuation of marginal users under the quota.

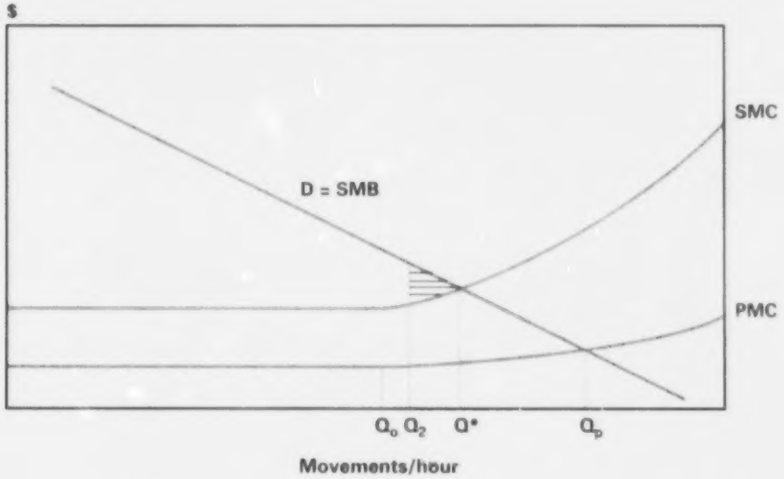
As illustrated in Exhibit 8, if the authority sets the traffic quota at $Q_2$ movements per hour, and the $Q_2$ movements are rationed efficiently, there will still be a welfare loss equal to the shaded triangle compared to the efficient quota level $Q^*$. This is because, for a traffic quota of $Q_2$, the marginal users' valuation of using the facility is greater than the marginal social cost. The result is that there are $(Q^* - Q_2)$ users not using the facility who value usage more than the marginal social cost (including the cost of the extra congestion that they impose on other users) of serving them; hence, the traffic quota should be expanded. But if the airport authority does not know the valuation of the marginal user, the authority does not know to expand the quota.

Hence, although slot allocation systems based on bargaining among users may allocate a fixed traffic quota efficiently, the airport authority's inability to observe the marginal user's valuation of usage precludes the adjustment of the quota to its efficient level. The result is that administrative methods may meet the first requirement for efficient use of fixed capacity (that a given level of use be allocated efficiently among users), but are unlikely to meet the second requirement (that utilization be set at the efficient level). Under these circumstances, the magnitude of the welfare loss will depend upon the airport authority's ability to estimate users' aggregate demand curve, and thereby the optimal traffic quota, $Q^*$. If, instead of estimating $Q^*$, the airport authority follows a policy of setting the traffic quota at the level where there is no congestion, $Q_o$, then a welfare loss is certain to ensue.

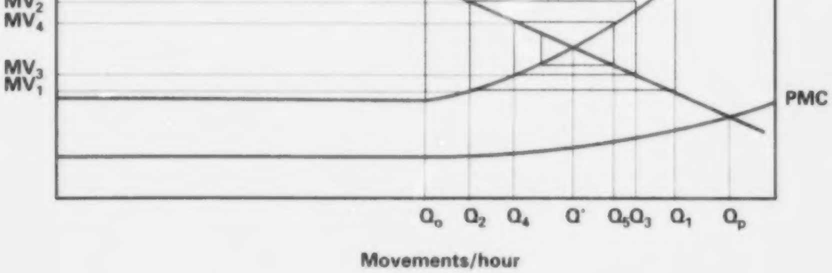
In addition to the uncertainties surrounding the efficiency with which it uses fixed airport capacity, an administrative allocation system may raise anti-competitive and cost-recovery concerns. Incumbent airlines have an incentive to resist the expansion of traffic quota if it will mean the admission of new airlines to the allocation process. If, for example, the airport authority seeks to expand the traffic quota beyond $Q_o$ while simultaneously admitting new airlines to the allocation process, the authority may be criticized by incumbent airlines on the grounds that the expansion of quota would lead to an increase in congestion greater than the benefits of increased usage. The criticism would be well-founded from the incumbents' point of view, but invalid from the point of view of social benefits. Hence, administrative allocation systems require an explicit mechanism for including potential entrants in the allocation process to prevent the system from becoming a barrier to entry.

Exhibit 8

AN INEFFICIENT QUOTA



ADJUSTMENT OF QUOTA TO ITS EFFICIENT LEVEL



### Slot Lottery or Auction

The problem of efficient administrative allocation can be solved by replacing the bargaining mechanism with an explicit market in which users buy and sell peak-period slots. Since in order to sell slots, users must be given property rights over slots, this raises the question of how property rights over slots are to be assigned initially.

Incumbent airlines may argue that, in view of their substantial investments in existing facilities, slot rights should be assigned on the basis of existing usage patterns. However, ceding slot rights to incumbent carriers raises the same competitive concerns that arise under administrative allocation. In fact, anti-competitive tendencies may be strengthened under a system that gives slot rights to users: an incumbent airline, for strategic reasons, may not be willing to sell slot rights to an entrant airline, even if the entrant is willing to pay more than the incumbent's valuation of the slot.

A system that assigns slot rights on some basis other than current usage could prevent anti-competitive activities. Rights could be assigned randomly through a periodic slot lottery conducted by the airport authority. Following a lottery, slots could be bought and sold among airlines, but the ownership of rights would not extend past the next lottery date. However, slot lotteries raise new equity concerns: the lottery system could assign windfall gains to low-valued entrants who could sell their lottery-won rights to high-valued incumbents. The possibility of windfall gains requires that safeguards, such as a registration fee, be built into the lottery system to deter illegitimate entrants. While providing windfall gains to some users, slot lotteries in their pure form would not provide revenue to the airport operator for cost recovery.

With a market, rather than a bargaining, mechanism to allocate a traffic quota, there is much greater certainty that efficient allocation will occur. The market mechanism would ensure that the traffic quota, once assigned by the lottery, would be redistributed among users on the basis of willingness to pay, since low-valued users would always be willing to sell slots to high-valued users. Furthermore, the periodic re-assignment of rights through lotteries would act as a deterrent to strategic behaviour by low-valued incumbent users.

The problem of setting the traffic quota at its efficient level would still remain since the airport authority must determine the level of the traffic quota to know how many slots to assign in the lottery. The market mechanism for rationing would, however, provide the airport authority with a clearer signal for adjusting the quota towards its optimal level than does the bargaining mechanism. The market clearing price for slots should be a good estimator of the valuation of the marginal user.[44] If the airport authority is able to observe this market clearing price — perhaps by acting as a market maker — then the authority could use this information to adjust the traffic quota in the direction of its optimal level at the next lottery.

Such an adjustment process is illustrated in Exhibit 8. The airport authority initially lotteries a quota of $Q_0$, and from the re-sale market for slots observes a marginal valuation of $MV_0$. The authority then calculates the level of quota at which social marginal cost equals $MV_0$, $Q_1$, and sets the quota at $Q_1$ at the next lottery.[45] After that lottery, the authority observes a marginal valuation, $MV_1$, and sets the quota for the following lottery at $Q_2$. This process continues, the airport authority using revealed marginal valuations to adjust the quota in the direction of its efficient level, $Q^*$. Following the cobweb path shown in Exhibit 8, it is evident that the quota converges to $Q^*$.[46]

Use of this algorithm for adjusting quota to its efficient level does not require the airport authority to know users' entire demand curve, but rather only to measure users' marginal valuation at a given quota by observing the market price of slot rights. Hence the algorithm, although presented here for the case of unshifting demand, should be robust to intertemporal shifts in demand. The algorithm's reliance on the market price as a measure of users' marginal valuation is, however, potentially fallible. Each user has an incentive to drive the quota above its socially optimal level, $Q^*$, to its privately optimal level, $Q_p$. To this end, users can potentially manipulate the quota adjustment mechanism by inflating the market price above its real level and paying unobservable refunds on the side. Therefore, although the use of a slot lottery system with a re-sale market provides a more efficient allocation of quota and a clearer signal for adjusting quota than does administrative allocation, there may still be incentive problems in measuring users' marginal valuation.

The equity and cost-recovery problems associated with random allocation of traffic quota can be overcome by replacing the slot lottery with a periodic auction of slots. The auction mechanism would allow an initial allocation of slots on the basis of users' willingness to pay, and hence would avoid equity problems. Allowing post-auction trading of slot rights would compensate for any allocative imperfections in the auction mechanism (such as those stemming from the dynamic nature of the auction process), ensuring that the final allocation is efficient. The proceeds of the auction would go to the airport authority, not to the windfall gainers, and could be used for cost recovery.

Although a system of slot auctions with a re-sale market would allocate a given traffic quota as efficiently as any other allocative mechanism with a re-sale market, the problem of determining the efficient level of quota remains. Under a slot auction system, the process of adjusting quota to its efficient level is complicated by the presence of two signals of users' marginal valuation: the minimum winning bid in the auction and the market price in the re-sale market.

### SMC Pricing

Each of the short-run facility use policies examined thus far — administrative allocation, slot lottery and slot auction — allocate a given traffic quota efficiently to differing extents, thus satisfying the first condition for efficient facility use. However, they all have a problem with satisfying the second condition since they all have to measure users' marginal valuations to determine the efficient level at which to set the traffic quota. This stems from the very nature of allocation systems that rely on quantity methods to control use by limiting use to a specified number of movements per hour. The alternative is to control use by setting a minimum marginal valuation, rather than a maximum utilization level. This is achieved simply by setting a price for usage and then letting any user who is willing to pay the price use the facility. Each price induces a unique level of use by users, as specified by the demand curve. Hence, the airport authority can control use at least as effectively by controlling the price that users pay for utilization as by controlling the level of use.

The immediate benefit of using price, rather than quantity control, is that the first condition for efficient use — that of allocating usage to users in the order of their valuations — is satisfied with certainty. This is because the price control acts as a rationing mechanism which induces low-valued users to sort themselves from high-valued users: for any given price only those users who value usage more than the price will be willing to pay and hence use the facility. Price control is more certain to achieve efficient allocation than are the other mechanisms considered thus far because the other mechanisms can initially produce inefficient allocations and, hence, must rely on re-sale markets to ensure efficient final allocation. Such re-sale markets, since they depend on trade among users to ensure allocation on the basis of willingness to pay, are prone to high transaction costs, imperfect information and strategic behaviour. By contrast, controlling use through pricing, because it puts a limit on user valuation rather than on use, always produces an efficient allocation: each user who values usage more than the price is guaranteed usage.

The problem is then to set the price at its efficient level, that is, the level that satisfies the second condition for efficient use. The efficient price is that which produces a level of use at which the social marginal benefit equals the social marginal cost, that is, the level Q* shown earlier in Exhibit 7. Hence the efficient price is SMC(Q*); a price set at SMC(Q*) is efficient because it imposes on each user the full social cost of marginal usage. This internalization of the user's congestion cost corrects the market failure (the divergence of social and private optimum) that occurs when users pay only their private marginal costs, and produces an equilibrium that is socially, rather than privately, optimal.

In order to make users pay the price, SMC(Q*), for facility usage, it is not necessary to charge a user fee or toll equal to SMC(Q*), since the user already pays the private marginal cost, PMC(Q*), to use the facility. It is only necessary to impose a toll of SMC(Q*) - PMC(Q*) to cause the users to internalize the social marginal cost of usage. Since private marginal cost is the same for all users and therefore equals users' social average cost (USAC), the optimal toll can be restated as SMC(Q*) - USAC(Q*), the social marginal cost less average user cost at the optimal level of utilization.

However, since the airport authority does not know the demand curve, only the cost curves, SMC(Q*) is not known and must be found through an iterative process analogous to that used to adjust the traffic quota. This algorithm for adjusting the user toll to its optimal level is encapsulated by the policy of continually setting the toll equal to SMC(Q) - USAC(Q), regardless of the utilization level (Q) that currently exists. Such a policy is known as social marginal cost pricing (SMC pricing). Convergence of the user toll to its optimal level under social marginal cost pricing can easily be demonstrated. Assume that facility usage is initially set at the maximum no-congestion level, $Q_0$. Social marginal cost pricing dictates initially setting a user toll equal to SMC($Q_0$) - USAC($Q_0$), which effectively shifts users' average cost curve, USAC curve, (and hence their PMC curve) upward by SMC($Q_0$) - USAC($Q_0$). In response, users will increase use to the private optimal level $Q_{p1}$, where the new PMC curve intersects the demand curve. If the airport authority then resets the toll to SMC($Q_{p1}$) - USAC($Q_{p1}$), users will respond by decreasing use to the new private optimum level $Q_{p2}$. The algorithm continues, with the airport authority using the users' quantity response as the basis for setting new SMC prices, until $Q_{pn}$ converges to $Q^*$ and the toll converges to its optimal level, SMC($Q^*$) - USAC($Q^*$).

The SMC pricing policy that forms the basis of this algorithm requires only knowledge of the facility's social and private marginal cost curves, not the demand curve. The algorithm does not require observation of users' marginal valuation because the trial prices used in the algorithm are essentially trial marginal valuations. The algorithm adjusts marginal valuation to its optimum level by observing quantity responses, rather than adjusting quantity to its optimum level by attempting to observe marginal valuation responses. The robustness of this price adjustment algorithm, in comparison to quota adjustment algorithms, is that it does not require the airport authority to observe an intangible quantity (users' marginal valuation in response to trial quotas), but rather only a tangible one (the level of usage in response to each trial price).

Thus far, the analysis of facility use has assumed a static demand curve. Introduction of differing levels of demand by time of day, season and calendar year is needed to model more closely the fluctuating, peak-load nature of demand that the airport planner faces. SMC pricing implies optimal user tolls that vary with the level of demand. A shift in the demand curve necessarily leads to a change in the socially optimal level of facility use (where the demand curve intersects the SMC curve), and hence a change in the optimal toll. For example, an increase in the level of demand leads to an increase in the socially optimal level of use, but, at that new level of use, marginal congestion cost is greater and consequently a higher toll is required to ensure that usage remains limited to those users who are willing to pay the social cost of their usage. In this manner, a policy of social marginal cost pricing recognizes the social justification for allowing congestion to increase when users' valuations of usage increase, but limits the increase in congestion to that justified by users' increased willingness to pay. Hence, SMC pricing dictates higher tolls when demand is high and lower tolls when demand is low. The implication for practical application of SMC pricing is that tolls should be higher during peak periods and peak seasons than during off-peak periods and seasons and also, that tolls should rise over the lifetime of a facility as demand increases.

## 4.3 PRICING POLICIES IN ACTION

As demonstrated, social marginal cost (SMC) pricing is the most efficient mechanism for regulating use of fixed airport facilities, since it ensures that usage is allocated only to those who value usage (in terms of their willingness to pay) at least as much as the social marginal cost of their usage. Charging a user social marginal cost means charging the user those social costs that would be avoided if the user did not use the facility. As applied to landing fees, SMC pricing therefore comprises three elements: the marginal airport operating cost of serving an aircraft, the marginal noise cost that the aircraft generates and the marginal congestion (delay) cost that the aircraft imposes on other aircraft.

The pattern of landing fees across aircraft types and time periods dictated by SMC pricing results from the relative magnitudes and variation by aircraft type and time period of each of the three elements of social marginal cost. Analysis of social marginal costs at Pearson International Airport indicates that marginal airport operating cost is small relative to the other two social marginal cost elements and is relatively constant (in the range of \$5–\$10) across aircraft types and time periods. Marginal noise cost varies by aircraft type (in the range \$25–\$200) and may vary to a lesser extent by time of day. Marginal congestion cost varies primarily by time of day (and season), and to a lesser extent by aircraft type, with large congestion costs (in the range \$130–\$220) during peak times and negligible congestion costs during off-peak times. Marginal congestion costs for light aircraft are almost as high as those for heavy aircraft, because a light aircraft occupies a runway for almost as long as a heavy aircraft, and the opportunity cost of a minute of runway time during a congested period is the same for all aircraft. The opportunity cost of runway time is high during a congested period because it factors in the high cost of delaying a heavy aircraft.

For congested airports, SMC pricing therefore implies a regime of landing fees characterized by a base fee equal to marginal airport operating and noise cost that applies during all times and varies by aircraft type, supplemented by an additional marginal congestion cost fee during peak times (and seasons) that varies somewhat by aircraft type. From the point of view of alleviating airport congestion, the key feature of SMC pricing is the large fee differential between peak and off-peak use for all aircraft.

Efficient allocation of airport resources is not the sole objective of government policy. As discussed earlier in this report, Transport Canada's proposed cost- recovery policy for airports sets the goal of recovering airport capital and operating costs. Under a cost-recovery constraint, an airport pricing system performs the dual role of allocating airport resources efficiently and generating the revenue required to recover airport capital and operating costs. Social marginal cost pricing automatically recovers airport operating costs because they are a social cost that varies with marginal airport use. Because SMC pricing deals with the problem of allocating airport resources efficiently in the short run — that is, given a fixed level of airport capacity — it does not charge users directly for the capital costs incurred in providing capacity.[47] Rather, users are charged marginal congestion cost, which varies with the level of traffic. Under SMC pricing, the airport authority must look to the revenue from congestion (peak-period) charges to recover capital costs and fund capacity expansion.[48]

The issue of whether the revenue generated from SMC pricing is in general sufficient to cover the cost of capacity investment has been examined from a theoretical perspective. The cost-recovery theorem developed by Mohring and Harwitz (1962, 1970) proves that, under certain conditions, the revenue generated by optimal congestion tolls will exactly equal the capital cost incurred by optimally timed investment.[49] These conditions are that capacity expansion be perfectly divisible, and characterized by constant returns to scale. Since airport terminal and runway capacity investments are typically highly indivisible (lumpy), there is no theoretical guarantee that, in general, the revenue generated by SMC pricing will exactly cover airport operating and capital costs. Depending on the level of congestion of an airport, the revenue from congestion fees may under-recover, exactly recover or over-recover capital cost.

Whether the revenue from marginal congestion cost fees is sufficient to offset capital costs clearly depends on the level of congestion at an airport. However, to determine whether capital costs will be recovered at a particular airport, it is not sufficient to compare annualized capital cost to the level of congestion fees in a single year, since the level of congestion, and hence the annual revenue from congestion fees, rises as traffic demand grows over time. Once the level of congestion reaches a critical level (when annual congestion fee revenue exceeds the opportunity (interest) cost of expansion capital), capacity expansion is justified; with expanded capacity, the level congestion and congestion fees returns to a low level. As Oum and Zhang (1990) have pointed out, whether the total revenue from congestion fees over an investment cycle (the time between initial and subsequent capacity expansion) is sufficient to recover capital cost depends on the time path of traffic demand growth.[50] For a given average demand growth rate, capital costs are more likely to be recovered if demand (and hence congestion) grows rapidly at the beginning of the investment cycle and then levels off, than if demand grows slowly at the beginning of the investment cycle and rapidly at the end.

Using a simulation model with demand and capacity parameters at Pearson International Airport, and assuming an average annual demand growth rate of 3.5 percent, Oum and Zhang found that the revenue from marginal congestion fees recovered capital costs, regardless of the time path of traffic growth. For an initial capacity of two runways, even the most pessimistic assumption regarding the pattern of traffic growth (slow growth in traffic in early years followed by acceleration in later years of the cycle) leads to (bare) cost recovery, generating a cost-recovery ratio of 1.01. More optimistic assumptions regarding the pattern of traffic growth generated financial surpluses, with cost-recovery ratios in the range 1.1 to 1.3. They also found that the cost-recovery ratio increased with the level of initial capacity, ranging as high as 2.3 for an initial capacity of four runways. The positive relationship between airport capacity and cost recovery of capacity increments is attributed to the fact that, at larger airports, capacity increments represent smaller percentage increments in capacity. With capacity expansion less lumpy in percentage terms, traffic grows sufficiently for congestion to re-emerge sooner after capacity expansion at larger airports than at smaller airports, with the result that larger airports generate congestion fee revenue sufficient to recover capacity expansion costs more rapidly than do smaller airports.

The implication of Oum and Zhang's findings is that for major airports with demand and capacity conditions analogous to those at Pearson, SMC pricing is likely to recover airport capital as well as operating costs. However, this finding is not applicable to significantly smaller airports where the relative lumpiness of capacity expansion and/or slow demand growth make cost recovery through congestion fees unlikely. Therefore, the conclusion is that marginal congestion cost peak fees, and hence SMC pricing, are likely to recover capital costs at large, congested airports, but unlikely to recover capital costs at small or uncongested airports.

Where SMC pricing does not recover costs, but cost-recovery is required, it is necessary to diverge from SMC prices to recover the revenue shortfall generated by SMC pricing. The most efficient such divergence is Ramsey pricing which, in the absence of externality (for example, congestion, noise) costs, differentially marks up prices above the airport's private marginal (operating) cost in inverse proportion to the demand elasticities of separable user segments. In the more general case where externality costs are present, Ramsey pricing marks up prices differentially over private marginal costs and a fraction of marginal externality costs. In both cases, Ramsey pricing recovers costs efficiently by marking up prices above marginal cost proportionally more for users who value usage more and less for users who value usage less. This ensures that the amount of traffic "choked off" by the mark-ups, and hence the efficiency loss due to divergence from SMC prices, is minimized.

Since Ramsey mark-ups vary in inverse proportion to the price elasticity of user demand, in practical terms Ramsey pricing implies landing fees that vary primarily by aircraft type, with larger aircraft charged higher fees than smaller aircraft. Ramsey prices may also vary by time of day, since an aircraft of a given type may have more inelastic demand for peak-period use than for off-peak use. Demand elasticities, and hence Ramsey prices, can also vary by stage-length (length of flight) and type of use (commercial, general aviation, military or government).

At major congested airports, SMC pricing will probably recover capital costs without the need to resort to the second-best Ramsey pricing policy. At non-major airports SMC pricing will not fully recover capital costs, in which case Ramsey pricing represents the most efficient way to recover the revenue shortfall. Therefore, in practical terms, the essential features of the landing fee policy dictated by efficient allocation of airport resources are:

- landing fees at major airports characterized by a large fee differential between peak and off-peak times of day (and seasons) for all types of aircraft, with relatively small variation in peak fees by aircraft type (reflecting differential runway occupancy times), and larger variation in off-peak fees by aircraft type (reflecting differential noise costs); and
- landing fees at non-major airports characterized by large variation in fees by aircraft type, and smaller variation in fees for each aircraft type between peak and off-peak periods.

Transport Canada's proposed cost-recovery policy for airports provides a basis for airport pricing that differs *conceptually* from the basis provided by efficient allocation of airport resources. Because Transport Canada's proposed policy is concerned primarily with cost recovery rather than with efficiency, it dictates that prices be based on direct allocation of variable and *fixed* costs to users, rather than based on the social *marginal* costs that airport users generate. The policy is characterized by:

- fees determined by allocating site-specific operating and capital costs to users;
- capital costs of runways allocated to commercial, state and military aircraft only (not to general aviation);
- airfield operating and maintenance costs allocated to all users on a per tonne of maximum take-off weight basis;
- terminal building capital and operating costs allocated to airlines, concession operators and passengers on the basis of usage; and
- peak-period fees at *major* airports that recover capital and operating costs in excess of those that would be incurred if demand were evenly distributed throughout normal operating hours of the day and throughout the year.

Although conceptually different from SMC and Ramsey pricing, in practice, the structure of landing fees suggested by Transport Canada's (TC's) proposed pricing policy is similar to that implied by SMC and Ramsey pricing. For non-major airports, TC's cost-recovery policy does not propose peak-period fees, but rather fees that vary on the basis of aircraft type both explicitly, in the provision that runway capital costs not be allocated to general aviation, and implicitly, by allocating airfield operating costs to users on the basis of maximum aircraft take-off weight. This variation in landing fees by aircraft type is consistent with Ramsey pricing. For major airports, TC's cost-recovery policy dictates variation in landing fees by aircraft type during off-peak periods, supplemented by a peak-period fee that allocates part of capital costs to peak users. Provided that the peak fee is to be applied to all peak users, TC's policy for major airports is structurally similar to SMC pricing.

The structural resemblance between TC's proposed pricing policy and SMC/Ramsey pricing indicates that TC's policy recovers costs in a relatively efficient manner. However, how efficient it will be depends to some extent not only on its qualitative similarity but its quantitative similarity to SMC/ Ramsey pricing. In particular, the TC policy dictates a peak/off-peak fee differential based on allocation of capital costs between peak and off-peak use, whereas SMC pricing bases the peak/off-peak fee differential on the different criterion of the marginal congestion cost differential between peak and off-peak times.

A specific comparison between peak fees under TC's proposed policy and peak fees generated by SMC pricing is not possible at present, due to the lack of an explicit formulation of TC's proposed peak fees. However, a more general comparison of magnitudes is possible. TC's peak/off-peak fee differential will likely be less than that generated by SMC pricing because cost-recovering SMC pricing allocates essentially all of capital cost to peak users (who generate the majority of marginal congestion costs), while the TC policy will partition capital costs between peak and off-peak users. In terms of the degree of peak pricing, the proposed TC policy, therefore, represents an intermediate state between the current pricing system, which does not differentiate prices by time-of-day, and the peak period pricing suggested by SMC pricing.

Exactly how close TC's proposed policy is to SMC pricing may not, in any case, be the key consideration in assessing its relative efficiency. Borins (1984) simulated the dynamic effects of various non-SMC pricing policies on the economic surplus generated by Pearson International Airport and found that "the social welfare surface surrounding the optimal policy [SMC pricing] is relatively flat for a substantial range, and that existing policies are also on this range . . . the welfare surface resembles a broad plateau . . . rather than peaking very sharply at the optimum resembling a mountain like the Matterhorn."[51] In concrete terms, Borins found that "the relative deviations [from the level of economic surplus induced by SMC pricing] of non-optimal pricing policies are quite small, always less than 1 percent for the low elasticity model and less than 5 percent for the high elasticity model."

These findings indicate that the efficiency loss, in terms of short-run use and long-run timing of investment, of pricing policies that lie between the existing policy and the optimal (SMC) policy is small in relative terms. The key consideration in assessing TC's pricing policy is not whether it corresponds exactly to the optimal SMC/Ramsey pricing policies, but rather that it represents an improvement over the existing policy that moves in the direction of optimal pricing. TC's policy approximates the price structure implied by SMC and Ramsey pricing by recovering costs in a manner that encourages efficient allocation of airport resources by discouraging use of congested facilities by low-valuing users during peak times, and allowing for use of uncongested facilities and off-peak times by all users.

## 5. A FRAMEWORK FOR EFFICIENT PLANNING AND DECISION MAKING

So far in this report, we have examined the airport planning process from two perspectives. First, the long-run problem is one of making investment decisions that maximize return on capital. Second, the short-run problem is one of efficient use of existing capacity through appropriate pricing schemes. In theory, this dichotomy between short-term and long-term decisions (or policy traces) should not exist, but, in practice, it is quite prevalent. Airport administrators are given the responsibility of operating existing facilities within certain policy and management guidelines. They function within the realm of operating budgets, planning revenues and expenditures to meet certain financial objectives. In the short run, excess demand is handled through rationing or, if possible, by improving the operating efficiency of existing facilities to increase throughput. The longer-term considerations regarding capacity expansion are dealt with in the realm of capital spending. Such decisions are subject to public investment guidelines, and are rarely seen as an extension of the airport's operating strategy. They present themselves as discreet events, which have tended to be in response to long-term growth projections in the past and, in more recent times, to severe congestions.

A rational model, based on sound economic principles, has to deal with the management of existing and construction of new facilities in an integrated framework. Although a distinction is drawn with respect to time horizons, investment and pricing both serve the same objective of efficient allocation of resources. The lumpy nature of airport investments may pose problems in the derivation of cost functions, which, in turn, may pose difficulties in determining efficient prices. In practice, however, sound application of cost-benefit principles in investment decisions and social marginal cost principles in pricing decisions, forms a common basis that provides adequate levels of capacity and allows for that capacity to be utilized.

Investment and pricing policies are evaluated against the criterion of economic efficiency. An efficient policy is one that maximizes net benefits to society. In the context of pricing policy, economic efficiency dictates operating an airport at the level of use where the social benefits of expanding use are just exceeded by the incremental social costs, including the cost of incremental congestion. Social marginal cost (SMC) pricing holds use and congestion to this efficient level by rationing use among users on the basis of their willingness to pay the social marginal cost. As users' willingness to pay (demand) increases, the efficient level of use and congestion increases, and the social marginal cost price rises. When congestion reaches a critical level, the congestion cost savings that can be achieved by expanding capacity outweigh the capital, and other social costs, associated with capacity expansion. Capacity expansion then is justified because it provides positive net social benefits. By controlling congestion growth, pricing policy affects the timing of investment. A pricing policy that diverges from social marginal cost can therefore lead not only to inefficient use of fixed capacity but also to inefficient timing of capacity expansion.

Under a cost-recovery constraint, pricing policies not only affect the timing of investment, but also provide the revenue required to fund investment. Social marginal cost pricing, because it recovers congestion — not capital — costs, will not necessarily recover the capital cost over a period of capacity expansion. However, for major Canadian airports, any revenue shortfall from SMC pricing is likely to be relatively small, and in some instances could lead to a revenue surplus.

If cost recovery is to be achieved, the alternative to SMC pricing is pricing based on allocating capital (and operating) costs to users. In Transport Canada's cost-recovery policy, landing fees vary among different aircraft types on the basis of maximum aircraft take-off weight rather than the amount of runway time used and congestion induced. A potential inefficiency associated with capital cost-based pricing is that prices do not necessarily rise with increased congestion as SMC prices do and, therefore, do not signal the relative scarcity of capacity to users. However, the relative loss of social welfare associated with these inefficiencies would be small for major Canadian airports. The argument for capital cost-based pricing is further strengthened if different prices are charged for peak and off-peak use, based on some estimate of the proportion of capital costs necessitated by peak use. Such a peak/off-peak fee differential performs a similar function to SMC pricing in shifting low-valued users from peak to off-peak times to use capacity more efficiently and delay the need for capacity expansion. In general, the proposed cost-recovery package provides a practical framework that would yield fairly efficient pricing practices at Canadian airports.

In investment policy, economic efficiency dictates the comparison of the social costs and benefits of potential capacity expansion options. The established tool for conducting this exercise is cost-benefit analysis (CBA). There are some technical difficulties in CBA, such as the need to estimate demand curves to obtain an adequate welfare measure of benefits and costs, and the need to choose a social discount rate to compare benefits and costs that accrue at different times. The use of CBA as an evaluation tool raises a number of issues that require further consideration in the airport planning context.

First, the timing of cost-benefit studies, as well as of actual investments, requires special attention. The Vancouver and Toronto studies both revealed that runway capacity expansions were overdue. Severe congestion has been imposing serious costs on airport users, which should have been detected earlier. As long as new investment considerations are delayed until congestion levels reach intolerable (or even noticeable) levels, appropriate remedies will always be implemented too late. This is exacerbated by the long lead times required for planning new capacity, and by the fact that congestion costs rise exponentially as capacity use approaches maximum physical capacity.

The high costs associated with overdue investment are demonstrated by the results of the Pearson study, which found the first-year benefit of two new runways in 1996 to be $140 million, as compared to a total capital cost of $469 million.[52] Assuming a social discount rate of 10 percent, in 1990 present-value dollars, the first-year benefit is $79 million and the capital cost $327 million. The cost of overdue runway expansion at Pearson is therefore approximately $46 million per year. This figure represents delay cost savings foregone by postponing runway expansion by one year ($79 million) less the opportunity (interest) cost of capital that is saved by postponing expansion by one year ($32.7 million).

A more general measure of the extent to which a project is overdue is the "first-year benefit ratio," the ratio of the first-year benefit to the total capital cost. If a project is overdue, the first year benefit exceeds the opportunity cost of capital (the discount rate times the total capital cost), and hence the first-year benefit ratio exceeds the discount rate. An optimally timed project is indicated by a first-year benefit ratio equal to the discount rate, and a premature project by a first-year benefit ratio less than the discount rate. In the case of Pearson runway expansion, the first year benefit equals 79/327 or 24%. Since the 24% return on capital that runway expansion produces in its first year of operation exceeds the 10% return on capital assumed in an alternate use, postponing the project would lead to a decrease in project net present value, and the project can therefore be deemed overdue. In relative terms, runway expansion at Vancouver was found to be even more overdue than at Pearson, with a reported first-year benefit ratio of 82% for the recommended runway option.[53]

The second problem with the application of cost-benefit principles to airport investment concerns the range of investment options considered in cost-benefit studies. In the case of Toronto, for example, investment decisions at the Lester B. Pearson International Airport have to be examined in the context of the regional airport system. Since there may be opportunities for diverting traffic to other airports (for example, Hamilton, Toronto Island or Buttonville), and the construction of a second stand-alone airport always remains a consideration, investments at Pearson are difficult to evaluate in isolation from other components of the airport system. This difficulty was partially overcome in the cost-benefit study by arguing that proposed airside development options were medium-term solutions, which could not be substituted by diversion or relocation of traffic to other airports. Although this constitutes a reasonable argument, it superficially limits the time horizon over which medium-term airside development options are evaluated.

In the Pearson case, the benefits and costs of options were evaluated over only 15 years from the year of implementation. Although the need for runway expansion was strong enough to justify expansion over the 15-year horizon in this case, in general this is an unreasonably short period of time over which to evaluate the economic viability of airport investment options. A more systematic approach capable of integrating evaluation of medium- and long-term airport investment options is therefore required. The Vancouver study used a 30-year time horizon and considered the development of alternate airports as an option. However, the percentages of different types of traffic that would divert to alternate airports, while partially based on access time-cost differentials, were largely assumed rather than being predicted by a multi-airport system model.[54]

The third problem that plagues the application of cost-benefit analysis to major airports relates to uncertainty associated with forecasts of benefits and costs. As noted earlier in this report, there have been times when official air traffic forecasts did not materialize, eliminating the need for additional capacity, or exposing examples of excess capacity (for example, Mirabel). Forecasting will always remain an uncertain art. The only practical solution is to evaluate investment options against different growth scenarios, and to look at alternative time horizons when considering each investment option. Such sensitivity analysis is an effective means of overcoming the inherent uncertainty attached to underlying parameters and assigning a degree of confidence to the results, as long as variation of underlying parameters over reasonable ranges does not affect the ranking of options. Sensitivity analysis also identifies important demand and other parameters that can significantly affect the results if they vary beyond critical ranges. Decision makers or experts can then assess the probability that these sensitive parameters will fall outside of critical ranges.

A source of uncertainty which is difficult to deal with is congestion delays under differing traffic levels and capacity options. This uncertainty results not only from the unknown delay properties of expanded infrastructure and forecast traffic volumes but also from inadequate knowledge of actual delays incurred on existing capacity by current levels of demand. The studies of Pearson and Vancouver airports both faced the problem of a lack of historical data on congestion delays. Both studies used discreet (aircraft by aircraft) simulation models of airfield operations to estimate delays, not only for capacity expansion options, but also for base-case (existing capacity) options. As long as delay forecasts are based solely on the predictions of simulation models, significant uncertainty about the delay forecasts will remain. Delay forecasts could be more accurate if more reliable data on actual delays were available to verify the delay predictions of simulation models.

Most of the problems associated with airport benefit-cost analysis can be alleviated by adopting a framework that facilitates continuous monitoring of costs and benefits. A social benefit and cost monitoring system would:

- Provide the data required to time cost-benefit studies optimally and to increase the level of confidence associated with study forecasts, and would provide the basis for an airport planning model that could incorporate multiple airports.
- Deal with incidents of externalities and other distributional issues. User costs and benefits could be compared to external impacts, such as neighbourhood noise costs or spin-off community benefits. The system could be used to disseminate information to the public, and to facilitate dialogue between opposing interests. It could serve as an effective means of mediating between conflicting interests, or at least provide grounds for compromise.
- Serve a useful purpose in pricing decisions by providing the data required for examination of the efficiency and revenue implications of alternative pricing schemes. Data on the social costs of airport operation could also be used to quantify externalities such as noise to provide the basis for taxation and compensation schemes.

In conclusion, from an economist's perspective we see the planning process as a continuous and comprehensive cost-benefit analysis. We see benefit-cost analysis not only as a "technocratic instrument" for investment appraisal, but an effective framework within which external impacts can be monitored and quantified, political compromises among different interest groups can be reached, and appropriate compensation mechanisms can be devised to make all concerned parties better off. The discipline of the new environmental review and assessment procedures has imposed the need for rigorous cost-benefit analysis in evaluating large projects, such as the international airports in Toronto and Vancouver. We propose that the scope of these cost-benefit studies be expanded to become a framework for continuous monitoring of airport costs and benefits, which we believe would constitute the basis for more rational decisions with respect to the economic efficiency of the airport system.

## ENDNOTES

1. See S. Borins, "Organization with Environment: A Review of Walter Stewart's *Paper Juggernaut*," *Canadian Public Policy* 6, 1 (Winter 1980), pp. 115–23 and S. Borins, "Self-Regulation and the Canadian Air Transportation Administration: The Case of Pickering Airport," in *Studies on Regulation in Canada*, ed. W. T. Stanbury (Montreal: Institute for Research on Public Policy, 1978), pp. 131–51.

2. See Transport Canada, Airports Authority Group, *Our First Year: 15 October, 1985–15 October, 1986* (Ottawa: Supply and Services Canada).

3. Geoffrey Rowan, "Community airports head for fast lane," *The Globe and Mail*, October 2, 1991, pp. B1, B6.

4. Transport Canada, Airside Capacity Enhancement Project Team, *Vancouver International Airport, Airside Capacity Enhancement Project, Airside Demand/Capacity Analysis* (June 1989).

5. Transport Canada, *Proposed New Cost Recovery Policy: Phase II* Discussion Paper, TP10041 (April 1990).

6. Transport Canada, Airports Authority Group, *Business Plan Framework, 1991/92–1993/94*.

7. For a review of indivisibilities in airport capacity, see T. H. Oum and Y. Zhang, "Airport Pricing: Congestion Tolls, Lumpy Investment, and Cost Recovery," *Journal of Public Economics* 43 (1990), pp. 353–74.

8. The latter applies, for example, to the valuation of externalities such as noise, which are not subject to property rights and hence have no established market price. Where market prices of costs and benefits do exist, they are used because they reflect the maximum that individuals are willing to pay in the presence of the market.

9. This principle was first introduced by N. Kaldor in "Welfare Propositions of Economics and Interpersonal Comparisons of Utility," *Economic Journal* 49 (1939). The compensation principle is a relaxed version of the Pareto principle, which requires that a policy make at least one person better off and no one worse off without compensation.

10. Equity objectives of Canadian transport policy are outlined in Royal Commission on National Passenger Transportation, *Getting There: The Interim Report of the Royal Commission on National Passenger Transportation* (Ottawa: Supply and Services Canada, April 1991), p. 221.

11. For a review of methods for incorporating distributional weightings into the evaluation criterion, see W. G. Waters, II, "Investment Criteria and the Expansion of Major Airports in Canada," *Canadian Public Policy* 3 (1977), pp. 23–35.

12. See, for example, Transport Canada, *Toronto Lester B. Pearson International Airport Airside Development Project, Final Report No. 24, Benefit/Cost Analysis*, TP10854E (April 1991), report prepared by Transmode Consultants Inc.; and Hickling Corporation, Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport (1990).

13. By NPV we refer in all cases to net present value evaluated in the current year, regardless of the start-date considered. Delaying the start date of an option will increase its NPV if the interest savings on expansion capital exceed the foregone net benefits of expansion.

14. See Oum and Zhang (1990).

15. If the capacity expansion project is to be evaluated using a fixed, finite economic life of n years, rather than a fixed horizon date or an infinite horizon, then there will be an additional benefit of delaying capacity expansion by one year: the net benefit in year n+1. The n+1 year benefit is not considered here for simplicity of exposition, and consistency with the literature (for example, Oum and Zhang (1990) use an infinite horizon). For applications where consideration of the n+1 year benefit is justified, use of the formula presented below understates the benefits of delaying expansion, and hence leads to later than optimal capacity expansion. Since the n+1 year benefit will normally be heavily discounted, the magnitude of the understatement is likely to be small. Simulation methods can be used to determine the exact optimal timing.

16. This assumes that increases in congestion cost savings over time are greater than increases in externality (noise) costs.

17. For discussion of this criterion see S. A. Marglin, *Approaches to Dynamic Investment Planning* (Amsterdam: North-Holland, 1963), and S. F. Borins, "The Effect of Pricing Policy on the Optimal Timing of Investments in Transportation Facilities," *Journal of Transportation Economics and Policy* 15 (1981), pp. 121–33.

18. If the expansion option requires a gestation period for construction before benefits are realized, then K is the capital cost compounded by r over the gestation period.

19. In the latter case, the optimal postponement period will be the longest period over which the average rate of increase of annual net benefits exceeds the discount rate. See E. J. Mishan, *Cost-Benefit Analysis* (London: George Allen & Unwin, 1982), p. 269.

20. Transport Canada, *Toronto Airside Development Project* (1991) and Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990).

21. If only a single expansion option is being evaluated, and if benefits are monotonically increasing over calendar time, and a long planning time horizon is in use, then this condition for optimal timing is not only necessary but also *sufficient* to recommend expansion. If the single option is optimally timed, so that its first-year benefit exceeds rK, then the present value of its benefits over all future time exceeds K (since the present value of a perpetuity of rK is $1/r \cdot rK = K$), and hence the option automatically has a positive net present value and can be recommended for implementation without explicitly calculating its NPV. Thus, conceptually, it is the optimal timing rule which forms the foundation for investment evaluation, with NPV analysis required to handle the more general case when more than one investment option is to be evaluated.

22. Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990).

23. Transport Canada, Airside Capacity Enhancement Project Team, *Vancouver International Airport, Airside Capacity Enhancement Project, Airside Demand/Capacity Analysis,* TP 9411E, (June 1989).

24. Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990), p. 8.

25. Federal Environmental Assessment Review Office, *Vancouver International Airport Parallel Runway Project: Report of the Environmental Assessment Panel* (1991), p. 40. The Panel also noted that inclusion of land costs would not have changed the study results.

26. Transport Canada, *Vancouver International Airport, Airside Capacity Enhancement Project* (1989), pp. 3–1, 3–3.

27. Federal Environmental Assessment Review Office, *Vancouver International Airport* (1991), p. 40.

28. In addition to this high benefit to cost ratio, the internal rate of return of the recommended option was also high at 114 percent.

29. Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990). It should be noted that the degree of confidence that can be placed in such a statement depends on the accuracy of the subjective probability distributions assigned to underlying assumptions. Risk analysis of the type conducted in the study does not eliminate uncertainty: it addresses one level of uncertainty but creates another.

30. An average delay of two minutes was forecast to remain in the first year after implementation of the runway (1993), which was found to be sufficient to generate incremental benefits to peak-period pricing. Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990), pp. 112, 116.

31. Ibid.

32. The FYBR of 82% implies that the annual cost attributable to overdue runway expansion in the presence of a $100 peak fee is approximately $44 million.

33. Transport Canada, *Toronto Airside Development Project* (1991).

34. Transport Canada, *Economic Impact of Alternative Traffic Management Options for Lester B. Pearson International Airport*, TP10668E (March 1991), report prepared by Hickling Corporation.

35. Estimation of benefits was made even more conservative by including only the benefits of using versus not using the airport, not the benefits of using peak versus off-peak times, in the calculation of generated user benefits.

36. No assessment of the allocative efficiency of administrative allocation versus congestion pricing is implied.

37. Transport Canada, *Benefit-Cost Model for Airport Approach Systems*, TP6887E (September 1986).

38. The analysis assumes that the demand curve is fixed and hence applies individually to periods of relatively constant demand.

39. For the purposes of this analysis, our assumption ignores the macroeconomic spin-off benefits that accrue from airport operation.

40. $MC_1$ is the passenger time and operating cost of using the airport of the average aircraft, and reflects the assumption of a constant aircraft mix over utilization levels.

41. The term "slot" generally denotes the right to land or take off (not both) once during a specified hour, daily, for one winter or summer season. S. G. Hamzawi, "Methods to Relieve Airport Congestion," *Proceedings of the Canadian Transportation Research Forum*, (1988).

42. D. W. Gillen, T. H. Oum and M. W. Tretheway, "Airport Pricing and Capacity Expansion: Economic Evaluation of Alternatives," *Transportation in Canada* (Ottawa: Transport Canada, 1990) TP10451E, p. 86.

43. For example, consider the case of an airport served by two airlines with the same operating configuration, costs and passenger demands. If the airport manager sets a peak-period traffic quota and informs the two airlines that they will not be permitted to fly until they work out a schedule that conforms to the quota, the two airlines will probably agree to split the quota in half and to each half assign their highest valued flights, producing an efficient allocation of the quota. In game theoretic terms, such an agreement represents a focal equilibrium.

44. The market clearing price will equal the marginal users' valuation less their PMC. Hence, assuming the airport authority knows the PMC curve, PMC can be added to price to obtain marginal valuation.

45. We assume here that the airport authority knows the SMC curve and that the demand curve is constant.

46. This algorithm is presented as an illustration of the use of market prices to guide quota setting. Although this algorithm does not necessarily converge (consider steepening the demand curve in Exhibit 5), other algorithms based on the same price information could be designed that would converge.

47. The practice of "long-run marginal cost" pricing — charging users for the "marginal" cost of capital as well as the marginal cost of airport operation, noise and (depending on the formulation) congestion — is not efficient. As Gillen, Oum and Tretheway (1990) note, with lumpy capacity investment "there is no smooth long run marginal cost curve . . . the long-run marginal cost curve is the collection of short run marginal cost curves." Therefore, a policy that allocates capital costs to users is not necessarily efficient. The efficient pricing policy charges users the short-run social marginal cost at the prevailing traffic level. This implies "charging higher prices [due to higher congestion] before any capacity investment, and lower fees after capacity is in place." Charges that vary over time with the level of congestion signal the relative abundance or scarcity of capacity to users and, hence, are more efficient than charges that allocate to users a fraction of capital cost that remains constant over time. See Gillen, Oum and Tretheway (1990), p. 91.

48. We ignore the possibility of using marginal noise cost fees to recover capital costs for the sake of simplicity, and because they may be required to fund householder noise compensation schemes.

49. H. Mohring and M. Harwitz, *Highway benefits: An analytical framework* (Northwestern University Press, 1962) pp. 84–86, and H. Mohring, "The Peak Load Problem with Increasing Returns and Pricing Constraints," *American Economic Review* 60 (1970), pp. 693–705.

50. The optimal timing of capacity expansion is itself determined by the level, but not the growth path, of traffic demand. See Oum and Zhang (1990), pp. 353–74.

51. S. F. Borins, "The Economic Effects of Non-optimal Pricing and Investment Policies for Substitutable Transport Facilities," *Canadian Journal of Economics* 17 (1984), pp. 80–97.

52. Transport Canada, *Benefit-Cost Analysis of Airside Development at Lester B. Pearson International Airport* (1991), pp. 36, 61.

53. Hickling Corporation, *Economic Analysis of Airfield Capacity Enhancement Strategies for Vancouver International Airport* (1990), p. 174. Hickling defined the first-year benefit ratio as the ratio of "all benefits in the first year after commissioning a project divided by the total costs incurred to that date, including interest" (p. 172). This formulation is equivalent to the ratio of present valued first-year benefit to present valued capital cost that we present. The first-year benefit ratio, a measure of project timing, should not be confused with the internal rate of return (the discount rate at which NPV equals zero), which is a measure of the rate of return of a project over its entire economic life and, hence, a measure of project merit.

54. Ibid., pp. 54, 63, 91.

## 19

# TRAVEL DEMAND BEHAVIOUR: SURVEY OF INTERCITY MODE-SPLIT MODELS IN CANADA AND ELSEWHERE

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## 1. INTRODUCTION

### 1.1 STUDY PURPOSE

The purpose of this study is to review the evolution of the intercity travel demand modelling state-of-the-art over the past 20 years, within Canada and, as applicable, elsewhere. In particular, the review summarizes the lessons which have been learned from this modelling work concerning Canadian intercity travel in general and intermodal substitutability in particular.

Given the emphasis on modal substitutability, this review focusses on the choice of mode in the travel demand modelling process. Trip generation/ distribution components are discussed, but these aspects of the overall modelling process are not reviewed in detail. In particular, the issue of the "induction" of new, previously unmade trips through the introduction of service improvements on one or more modes is not comprehensively explored.

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This review is not intended to assess the relative accuracy of the various Canadian intercity demand models which have been developed and applied over the years. Rather, it is intended to assess what has been learned from these models that is applicable to understanding and forecasting Canadian intercity travel demand. Thus, the study spends virtually no time reviewing the actual forecasts generated by these models. Instead, it focusses on the elasticities, values of time and other fundamental indicators of travel behaviour that can be extracted from these models. In so doing, the review also inevitably deals with methodological issues associated with the specification, estimation and application of these models, since the empirical results (elasticities, etc.) obtained from these models can only be evaluated within the theoretical and methodological context within which they are obtained.

The primary focus of the review is necessarily on Canadian intercity mode-split models. Every Canadian multimodal[1] model of consequence reported in the literature is reviewed in this report. U.S. models of significant relevance to the Canadian context, in particular those which appear to represent the current state of practice, are also reviewed in detail. Non-North American models are generally not reviewed in detail, typically due to a lack of transferability to the North American context and/or a lack of detailed information concerning the models' functional forms, assumptions, etc.

Time and resource constraints and, more particularly, lack of access to original model data sets prevented any new analysis from being undertaken within this study. Given the complex, non-constant nature of the elasticities associated with virtually every model reviewed here, this review contains only empirical elasticities which have been reported in the models' documentation, since sufficient information to compute meaningful elasticities given a model's functional form and estimated coefficients was rarely available.

## 1.2 REPORT ORGANIZATION

Section 2 of this report provides a brief background discussion of several issues that are of particular importance in assessing the state-of-the-art of intercity travel demand. In particular, the fundamental issue of choice of model aggregation level is discussed in some detail. Primarily motivated by this discussion of the aggregation issue, the review of specific intercity mode-split models is presented in two sections. Section 3 deals with aggregate modelling efforts, while Section 4 deals with (typically more recent) disaggregate models. Finally, Section 5 summarizes the findings of this detailed review with respect to empirical results, methodological issues and directions for further model development.

## 2. DISCUSSION OF ISSUES

### 2.1 INTRODUCTION

This section discusses several issues which have a direct impact on the results which are obtained from intercity passenger travel demand models and, hence, must be considered in any evaluation or discussion of these models. These issues include:

- spatial aggregation level and model transferability;
- travel market definition; and
- model specification.

### 2.2 LEVEL OF AGGREGATION

Travel demand models are typically developed at one or the other of the following two levels of *spatial aggregation*:

- the *aggregate* level, in which total trips (by mode) between zones are modelled directly; and
- the *disaggregate* level, in which trips by individuals are modelled directly (and the aggregate zone-to-zone flows required for policy analysis are then generated by explicitly or implicitly adding up all the trips made between these zones by these individuals).

By far the majority of intercity passenger travel demand models fall into the aggregate category, although in the last 5 to 10 years, models have been at least partially disaggregate in nature. Aggregate models typically possess several practical advantages. In particular, their input data requirements are generally much more modest than those of disaggregate models and are also generally more consistent with the information which often has been available for model construction. Further, such models are generally easier to apply, since they are developed directly at the level of policy interest, that is, the level of city-to-city flows.

Aggregate models, however, can be criticized with respect to several aspects.[2] The most fundamental of these is that aggregate models inherently run the risk of having incorporated within them unknown amounts of *aggregation bias*. Figure 2-1(a) illustrates the concept of aggregation bias. In this figure, a hypothetical demand curve is assumed. The precise nature of the curve is not of immediate importance, except that it is non-linear in nature (certainly not an unreasonable assumption). The demand curve shown expresses the probability of an individual choosing a particular mode of travel for a trip as a function of the person's income, where all other factors affecting this modal choice (modal levels of service, trip purpose, etc.) are assumed to be held constant. Two individuals (1 and 1'), possessing very different income levels are shown ($I_1$ and $I_{1'}$), along with their mode choice probabilities ($P_1$ and $P_{1'}$). The average income for these two individuals ($I$) and their average choice probability ($P$) are also shown. Points to note from this figure include the following:

- A disaggregate model would attempt to reproduce the demand curve shown in Figure 2-1(a) by statistically relating the observed response of each individual trip-maker to his/her individual characteristics.[3] Such a model will inevitably contain some error, due to the use of "approximate" functional forms, omission or mismeasurement of explanatory variables, etc. But such a model, if properly constructed, will not be inherently biased in terms of its model parameter values.
- An aggregate model, on the other hand, would typically be developed by statistically relating the observed *average* response for an aggregation of trip-makers as a function of the *average* characteristics of these trip-makers; that is, point {I,P}, combined with comparable points for other groups, that is, average values for other zones or zone-pairs, as the case may be.
- Point {I,P} does *not* lie on the true demand curve and, in general, will not lie on the curve unless the curve is linear (a very unlikely event). Thus, any model based on aggregate data such as {I,P} will not likely be able to reproduce the true relationship between modal choice and income. Figures 2-1(b) and 2-1(c) illustrate two extreme but not inconceivable examples in which the assumed aggregations lead to either no apparent relationship between mode choice and income (Figure 2-1(b)) or a positive relationship (that is, increasing modal use with increasing income, as in Figure 2-1(c)), when in both cases the same true underlying relationship of a negative relationship between mode choice and income (that is,

modal use declines with increased income, as in Figure 2-1(a)) is generating the observed aggregate results. Clearly, models developed from the data shown in either Figures 2-1(b) or 2-1(c) will be seriously in error — that is, biased. And, in general, *any* spatially aggregate model will be subject to some unknown level of bias.

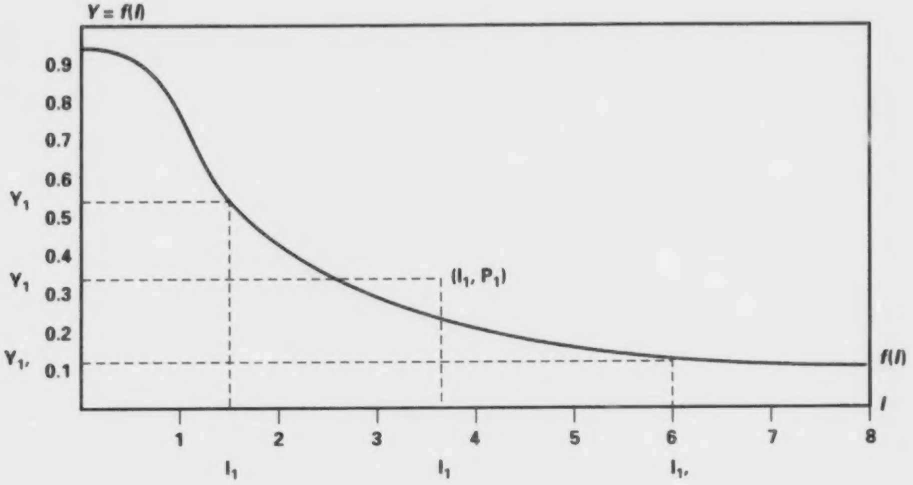
The problem of aggregation bias is lessened in situations in which zones are relatively homogeneous with respect to the variable(s) being aggregated. This is rarely the case, however, in intercity models, in which a "zone" is typically an entire urban area ("Toronto," "Montreal," etc.), within which potentially important explanatory variables, such as income, occupation, family composition, access/egress times and costs, etc., all will vary dramatically and in complex ways.

The impact of aggregation bias can also be minimized if the model is more or less restricted to policy variables involving relatively little bias (for example, city-to-city travel times and costs) and it can be argued that the "net" effect of all other factors (income, etc.) are "captured" within the model's parameters in a way which is unlikely to change significantly over the forecast period. Many aggregate intercity demand models at least approximately fall into this category in that they contain relatively few (if any) socio-economic variables (which are particularly sensitive to aggregation biases). The critical question, of course, is whether the net effect of all other factors is, in fact, constant over time (or otherwise properly controlled for) within such models.

The second major issue with respect to aggregate models, which really represents an extension of the aggregation-bias problem, is that of model transferability. It should be clear that, regardless of whether an aggregate model is "fatally" biased or not, its potential to be transferred from the area for which it has been developed to another area is extremely limited, since the net effects embedded within the aggregate model are likely to be quite different from one area to the next. Thus, a model developed for one travel corridor or one country is very unlikely to be readily transferable to another corridor or country. This has certainly been the case for urban travel demand models and, as is discussed further in subsequent sections of this report, the available evidence indicates that this also seems true for intercity models. Hence, it is likely that, at best, only very generalized results might be transferred from one region of the country to another, or from one country to another.

Figure 2-1
AGGREGATION BIAS EXAMPLE

CASE (a)



CASE (b)

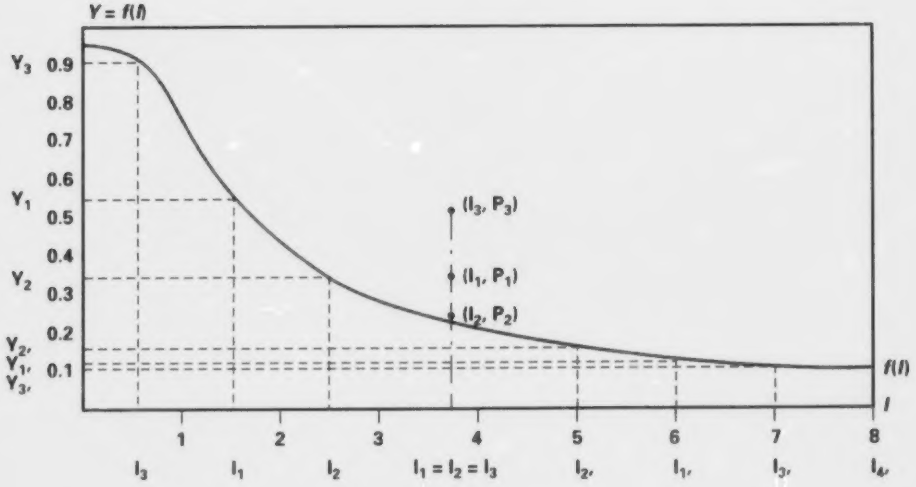
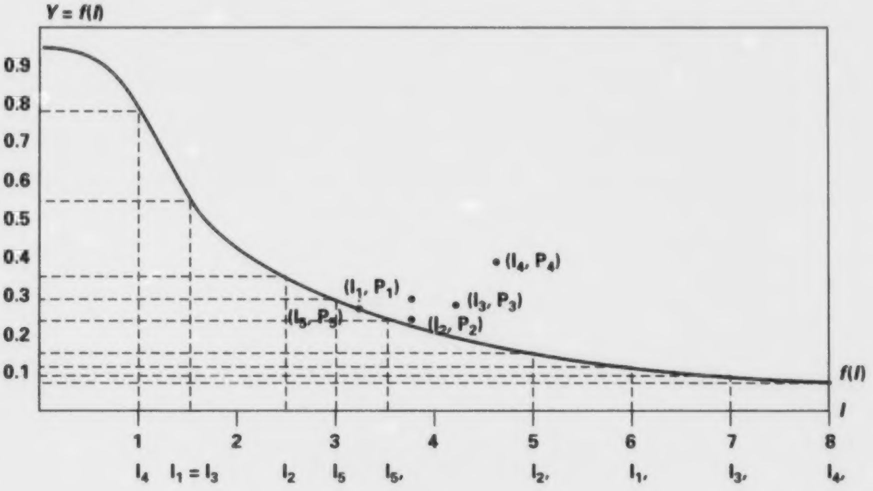


*Figure 2-1 (cont'd)*
AGGREGATION BIAS EXAMPLE

CASE (c)



## 2.3 TRAVEL MARKET DEFINITION

It is widely recognized in the demand modelling literature that intercity travel must be disaggregated by trip purpose. At a minimum this means developing separate models for business and non-business purposes in recognition of the very different behavioural processes, choice elasticities, etc., that exist within these two very different travel markets. Further disaggregation of non-business trips (into purposes such as "visit friends and relatives," "personal business," "vacation," etc.) typically depends upon data availability and the importance of distinguishing between these various sub-markets within the given corridor or region under analysis.

Further market categorization, however, is generally possible and usually desirable. In particular, it is likely that significant differences in modal availability and decision processes exist between short-distance and long-distance intercity trips, although where the break point between short- and long-distance trips lies is not necessarily well understood. Similarly, it is not clear that linear travel corridors and more general regional or inter-regional travel systems behave in similar ways that can be captured equally well by the same model. Thus, some form of spatial categorization, on the basis of distance and/or travel system structure, may well be necessary to understand properly the intercity travel market as a whole.

This discussion of market categorization is, of course, another example of the aggregation issue discussed in the previous section. By categorizing the market "properly," one is attempting to identify travellers who are relatively homogeneous in both their decision-making process (time-cost trade-offs, etc.) and the environment within which these decisions are made (available modes, relevant modal characteristics, etc.). A particular difficulty with this market segmentation process is that it generally must be done prior to formal model estimation, with the result that statistically rigorous selection of the "optimal" categorization scheme is often difficult to achieve. Further, segmentation means that two or more models based on sub-samples within the overall set of observations will be developed, with a possible loss of statistical significance in parameter estimates. This makes market segmentation a tedious, inevitably somewhat ad hoc process which probably has not been explored in most modelling efforts as extensively or as consistently as one might wish.

An alternative to market segmentation is the use of categorizing variables directly within the model functional form. These can include spatial, purpose or socio-economic variables. Thus, for example, it is very common to include income directly within an intercity mode-choice model as an explanatory variable, rather than to estimate different models for different income groups. Inclusion of such variables within the model itself, however, usually involves very strong (and typically simplistic) assumptions concerning the effect which these variables have on the decision process being modelled. Further, they too typically involve a fairly ad hoc, trial-and-error search for the "best" combination of variables, although at least in this case some parametric statistical tests (*t*-tests, etc.) are available to aid the search.

## 2.4 MODEL SPECIFICATION

A considerable portion of the intercity travel demand modelling literature has focussed on the question of choice of functional form for these models. As discussed in greater detail in Rice et al. (1981), much of the early discussion of this issue was somewhat spurious in that the various model forms considered at the time were simple algebraic variations of one another (for example, most one-stage "direct" demand models could be algebraically decomposed into a two-stage model and vice versa). As the range of modelling methods has expanded, however, significantly different model functional forms have emerged that will produce significantly different modelling results (descriptively and predictively), even when calibrated using the same data base. Further, the ability to capture these different functional forms as parametric variations of more general functional forms — and hence to test statistically the relative merits of these alternative functional forms — has grown over the years.

The selection of model functional form is fundamental to the modelling process in that it determines the data required to estimate the model, the estimation procedure used to determine model parameters (and the tractability and efficiency of this procedure) and, most importantly, the overall behaviour of the model in terms of its predictions of future system behaviour under the range of policy tests of interest. Functional forms should be selected on the basis of theoretical plausibility, goodness-of-fit to observed data, predictive feasibility and predictive performance. The last of these is, of course, of greatest practical importance but is the most difficult to assess, particularly when one is dealing with hypothetical alternatives such as the introduction of high-speed rail services into North American travel corridors. Thus, in practice, one tends to rely on theoretical reasoning and empirical descriptive results (that is, goodness-of-fit to observed data) in developing a model that one hopes will then predict well into future, unobserved situations.

# 3. AGGREGATE INTERCITY TRAVEL DEMAND MODELS

## 3.1 INTRODUCTION

Before the 1980s, virtually all operational intercity travel demand forecasting models were totally aggregate in nature. As discussed further in Section 4, disaggregate mode choice models began to be developed in the 1970s and early 1980s. This trend has continued (for all the theoretical reasons discussed in Section 2) to the point that disaggregate mode choice models are now the operational norm.[4] Trip generation/distribution models, however, typically remain specified at the aggregate level. In general, these later models have not changed substantively in the last 20 years.[5]

Non-Canadian aggregate models from this early era of the 1960s and 1970s are well reviewed elsewhere,[6] and it would serve little purpose to repeat such a review, given the weak theoretical content of most of these models, the lack of transferability of their results, and the extent to which they have been superseded by more recent, methodologically sounder methods (at least, with respect to mode choice models). Rather, this section focusses on major Canadian efforts in the development and use of aggregate intercity travel demand models.

Two major operational aggregate models were developed during the 1970s in Canada: the Canadian Transport Commission (CTC) model, developed in 1969–1970 for the Windsor–Quebec City corridor; and Transport Canada's PERAM model, developed in the mid-1970s for Canada-wide intercity travel. Subsection 3.2 reviews the CTC model in some detail, both because it is representative of the aggregate modelling state-of-the-art circa 1970 and because it defines the point of departure for most of the Canadian modelling efforts which have followed.

Unfortunately, very little detailed information concerning PERAM is available publicly. Major studies which made use of PERAM (such as the 1984 VIA Rail Review[7] and the Southern Ontario Multimodal Passenger Study (SOMPS)[8]) typically provide qualitative overviews of the model, as well as the end forecast results — neither of which provide the sort of detailed technical information of direct interest to this review. PERAM, however, was derived from the econometric investigations of Gaudry and Wills (1978) which forms part of the material discussed in the next paragraph and, hence, is discussed in this context.

Another type of aggregate modelling work which seems to be more or less uniquely Canadian consists of investigations by several Canadian economists (Gaudry, Wills, Oum, Gillen) of the functional form of intercity travel demand models and the implications which the choice of functional form has on intercity demand elasticities. This work is of direct importance here, both from the methodological point of view of what it implies for model specification and selection, and in terms of the empirical results obtained concerning Canadian travel demand elasticities. This work is summarized in subsection 3.3.

## 3.2 THE CTC MODEL[9]

Although slightly over 20 years old, the model developed by the Canadian Transport Commission (CTC) from 1969 survey data for the Windsor–Quebec City corridor as part of its Intercity Passenger Transport Study represents an important starting point for reviewing Canadian intercity passenger travel demand models, for several reasons, including:

- It represents the first significant intercity demand model developed in Canada.
- It is one of the best documented models in Canada.
- It is representative of the state-of-the-art in intercity demand modelling as of the late 1960s and early 1970s.

The CTC model is a two-stage model of common carrier demand (air, rail and bus modes) in the Windsor–Quebec City corridor, defined by the following system of equations:

$$V_{AB} = K_T P_A P_B{}^{1.08} L_{AB}{}^{1.30} e^{-0.7/r_A} e^{0.23(D-T)} (C-P)^{-0.41} W^{0.205} \qquad [3.1]$$

$$\mathrm{MS}_i = w_i / W \qquad [3.2]$$

$$w_i = K_i T_i^{-3.05} C_i^{-4.85} e^{-3.9/F_i} \qquad [3.3]$$

$$W = \Sigma_i \, w_i \qquad [3.4]$$

where:

$V_{AB}$ = total annual trips generated from city A to city B by common carrier

$K_T$ = constant (= 2.73)

$P_A$, $P_B$ = populations of city A and city B (thousands)

$L_{AB}$ = index of linguistic pairing between cities A and B ($0 \leq L_{AB} \leq 1$)

$r_A$ = fraction of families with annual incomes greater than $12,000

$D$ = highway driving time (centre to centre) (hours)

$T$ = average total trip time by common carrier, weighted by modal split (hours)

$C$ = average total trip cost by common carrier, weighted by modal split (dollars)

$P$ = perceived cost of car ($0.03/vehicle-mile; 2.15 persons/vehicle)

$W$ = level of service of the common carriers as defined in the modal split model

$MS_i$ = fraction of traffic (modal split) using mode $i$ (for city-pair A-B, the AB subscripts are deleted for simplicity of presentation)

$w_i$ = level of service of mode $i$

$W$ = system impedance or overall common carrier level of service

$T_i$ = total user trip time (includes access, egress, terminal waiting and block times) (tens of hours)

$C_i$ = total user trip cost (includes access, egress and fare costs) (tens of dollars)

$F_i$ = perceived daily departure frequency

$K_i$ = modal constant (air = 31.8, rail = 10.0, bus = 1.65)

The two-stage structure (total demand, mode split), the use of ad hoc "trip induction" terms ($W$) in the total demand equation, and the multiplicative nature of both equations [3.1] and [3.3] are all typical of the modelling state-of-the-art at the time of this model's development. Also typical is the estimation procedure (linear regression using "linearized" versions of these equations) which uses relatively few observations (in this case 34 city-pairs) to estimate a relatively large number of model parameters (eight in the total demand equation, six in the mode-split model). Somewhat unusual features of this particular model include the lack of explicit demand forecasts for the car mode (primarily due to data limitations) and the use of the "linguistic pairing" term to deflate the level of interaction between city-pairs within the corridor on the basis of their relative linguistic compatibility.

The exponents on the population terms in equation [3.1] of 1.0 and 1.08 imply that total common carrier demand between any two city-pairs has constant unit elasticity with respect to either city's population. This, in turn, implies that if the population of the two cities were to double, then the common carrier demand for the city-pair would quadruple. The unit elasticity result is extremely unlikely and is undoubtedly the result of estimating the model on a very small sample of cross-sectional observations. A larger sample of observations taken over time would almost certainly yield improved estimates of the population effects, which would almost certainly involve exponents (and hence elasticities) significantly less than one in value (assuming that the same function form was used).

Similarly, the "trip induction" terms in this model are equally suspect. Note that a decrease in rail travel time, for example, has three effects in this model. It increases rail's common carrier modal split, since $w_{rail}$ will increase relative to $W$. It also, however, increases the total common carrier demand, both through a decrease in $T$ (average common carrier trip time) and an increase in $W$ (common carrier level of service). This increase in common carrier demand presumably consists partially in shifts in exisiting trips from the car mode to a common carrier mode and partially in the generation of new, previously unmade trips. Problems with this approach include the following:

- Without explicitly modelling the car mode, it is very difficult to ensure that the "shift from car" effect is being captured properly.
- The cross-elasticities of common carrier volumes by mode with respect to car travel times and costs implied by this model are 0.23 and 0.41, respectively. That is, they are constant across the three common carrier modes. This is an extremely unlikely result. The constant car cost cross-elasticity is also implausible. The magnitude of the cost cross-elasticity also appears large, at least with respect to urban modelling results, in which (short-run) car usage is generally found to be quite cost-inelastic. The increase in the car time cross-elasticity with total trip time is a much more plausible result, although the appropriateness of the order of magnitude of this cross-elasticity is not easy to judge.

- The model implies that the total common carrier demand elasticity with respect to aggregate level of service (*W*) is 0.205. This, again, is most likely an overestimate of the trip induction effect, again due to estimation of the model from a small, cross-sectional data set. It is very unlikely that the true, net increase in trips attributable to level-of-service changes can be statistically identified from cross-sectional data, since the potential for spurious correlations, etc., is simply too great.
- There is no logical constraint in the way that common carrier level-of-service terms (that is, *T*, *C* and *W*) enter the total demand equation to ensure that total demand elasticities have the correct signs with respect to level-of-service variables. This is illustrated in Table 3-1, in which zero or marginally positive total demand elasticities occur for certain modes, service variables and origin-destination pairs. In each case, this result implies that increasing the travel time or cost (as the case may be) for a given mode results in no loss or even a slight increase in total common carrier ridership — a result which can only happen if one or more of the unchanged modes gains some new, "induced" riders, over and above those it gains from the mode experiencing the level-of-service change. This is clearly an illogical result, but one to which models of this general form are particularly prone.

Ignoring "trip induction" effects, the direct and cross-elasticities of a mode *i*'s share of the market with respect to change in level-of-service variable *k* for mode *j* are given by:

$$e_{iik} = \begin{cases} \beta_k(1 - P_i) & \text{for } k = \text{time or cost} \qquad [3.5.1] \\ (\beta_k/F_i)(1 - P_i) & \text{for } k = \text{frequency} \qquad [3.5.2] \end{cases}$$

$$e_{ijk} = \begin{cases} -\beta_k P_j & \text{for } k = \text{time or cost; } j \neq i \qquad [3.6.1] \\ -(\beta_k/F_j)P_j & \text{for } k = \text{frequency; } j \neq i \qquad [3.6.2] \end{cases}$$

where:

$\beta_k$ = model coefficient for the *k*th variable

$P_i$ = modal split for mode *i* (fraction)

$F_i$ = frequency for mode $i$

Points to note concerning these modal split elasticities include the following:

- Cross-elasticities are constant across the unchanged modes. For example, the cross-elasticity of the air modal split with respect to a change in rail service is the same as the bus mode's split with respect to this same change (since equations [3.6.1] and [3.6.2] do not depend on the unchanged mode $i$, only the changed mode $j$). This is illustrated in Table 3-1, in which the cross-elasticities found in any column are the same (marginal differences in total demand sensitivities aside). This is generally viewed as a rather undesirable property of mode-share models of this nature. As discussed in subsection 4.2, this is, however, a property which is common to many mode-split models.
- In general, the model implies that direct elasticities are greatest in magnitude when modal shares are smallest (that is, equation [3.5.1] states that $e_{iik}$ has a maximum value of $\beta$ when mode $i$ has zero modal share) and decrease linearly with increasing modal share. Conversely, cross-elasticity magnitudes increase linearly with the modal share of the mode being changed (that is, mode $j$), reaching a maximum when the changed mode has 100 percent of the market. The general nature of these relationships is intuitively reasonable, although the strict linear nature of the relationship between mode share elasticity and mode share may be overly simplistic.
- Given these elasticity relationships in combination with the very large model coefficients in equation [3.3], very high elasticities, especially direct elasticities, can be anticipated. This is confirmed in Table 3-1, in which the direct-fare elasticities are considerably greater than 1.0 in magnitude, and the bus and rail direct-time elasticities are generally greater than 1.0 in magnitude.

*Table 3-1*

TIME AND FARE ELASTICITIES, CTC MODEL

| Effect on volume | Montreal–Toronto | | | | | |
|---|---|---|---|---|---|---|
| | Schedule time | | | Fare | | |
| | Air | Rail | Bus | Air | Rail | Bus |
| Air | –0.62 | 0.84 | 0.22 | –2.75 | 1.61 | 0.40 |
| Rail | 0.29 | –0.35 | 0.22 | 1.27 | –2.59 | 0.40 |
| Bus | 0.29 | 0.84 | –2.15 | 1.27 | 1.61 | –3.87 |
| **Total** | **–0.21** | **0.01** | **0.00** | **–0.90** | **0.01** | **0.07** |

| Effect on volume | Ottawa–Montreal | | | | | |
|---|---|---|---|---|---|---|
| | Schedule time | | | Fare | | |
| | Air | Rail | Bus | Air | Rail | Bus |
| Air | –0.46 | 0.72 | 0.36 | –2.97 | 1.45 | 0.73 |
| Rail | 0.07 | –0.82 | 0.36 | 0.43 | –1.66 | 0.73 |
| Bus | 0.07 | 0.72 | –1.44 | 0.43 | 1.44 | –2.91 |
| **Total** | **0.01** | **–0.21** | **–0.16** | **0.06** | **–0.42** | **–0.32** |

| Effect on volume | Toronto–Ottawa | | | | | |
|---|---|---|---|---|---|---|
| | Schedule time | | | Fare | | |
| | Air | Rail | Bus | Air | Rail | Bus |
| Air | –0.58 | 0.07 | 0.36 | –2.71 | 1.22 | 0.66 |
| Rail | 0.27 | –1.52 | 0.36 | 1.26 | –2.64 | 0.66 |
| Bus | 0.27 | 0.71 | –1.88 | 1.26 | 1.22 | –3.48 |
| **Total** | **–0.19** | **0.04** | **–0.01** | **–0.87** | **0.07** | **–0.03** |

The linearization of the mode-split model involves defining a "base" mode, dividing equation [3.2] for each of the "non-base" modes by equation [3.2] for the "base" mode and then taking logarithms of both sides, yielding:

$$\log(\mathrm{MS}_i/\mathrm{MS}_b) = \log(K_i/K_b) + a^* \log(T_i/T_b) + b^* \log(C_i/C_b) + c^*(F_b/F_i) \quad [3.7]$$

where the subscript b indicates the base mode, and $K_i$, $K_b$, $a$, $b$ and $c$ are the model parameters to be estimated.

As shown by Wills (1981), application of ordinary least-squares to equation [3.7] will result in biased model coefficient estimates that will vary depending on the base mode chosen. Wills demonstrated that a multi-step generalized regression procedure eliminates this bias. The key point, however, is that all models which were estimated using this form of linearization and ordinary least-squares regression will contain some level of bias and may generate unreliable forecast results.

## 3.3 INVESTIGATIONS INTO MODEL FUNCTIONAL FORM

Gaudry and Wills (1978) showed that many of the common intercity model functional forms developed to that point represented special cases of a very general model form constructed through the use of Box–Tukey or Box–Cox transformations of the dependent and independent variables within a general linear regression model. Generalized mode-split and total demand equations were eventually estimated for four modes (air, rail, bus, car) using 1972 data for 92 Canadian city-pairs. Focussing on the mode-split model, the general equation assumed is:

$$\mathrm{MS}_m = \frac{\exp\,[\alpha_{m_0} + \Sigma_k\, \alpha_k (C_{m_k} + \mu_{1,k})^{(\lambda_{1,k})}]}{\Sigma_m \exp\,[\alpha_{m_0} + \Sigma_k\, \alpha_k (C_{m_k} + \mu_{1,k})^{(\lambda_{1,k})}]} \qquad [3.8]$$

where $\mathrm{MS}_m$ is mode *m*'s mode share, the various $\alpha$ terms are model parameters, the $\mu$ and $\lambda$ terms are the transformation parameters which control the specific functional form of the model, and $C_{m_k}$ is the *k*th explanatory variable for mode *m*. Only three explanatory variables are used in the models estimated: the fare, *F*, the travel time, *H*, and the frequency, *D*.

Various specific models were then estimated involving different assumptions concerning the $\mu$ and $\lambda$ parameters. In particular, the multiplicative model (such as used in the CTC model) is recovered if these parameters are all set equal to zero. Similarly, setting the $\lambda$ terms equal to zero and the $\mu$ terms equal to one yields the standard multinomial logit model (see Section 4 for further discussion of this model).

Table 3-2 summarizes the estimation results for the five models tested, where these models have been arranged in order ranging from the most general on the left (labelled "TLCS-2") to most restricted on the right (the "log-linear" or multiplicative model and the logit model, which represent different but equally restrictive assumptions on functional form). As indicated by the log-likelihood values for the various models ($L_1(\lambda, \mu)$), the more general the model, the better the overall fit of the model. Up to a point this is a straightforward result: the more parameters a model has (that is, the less restricted the model), the better it will generally fit a given data set.

There are, however, at least two points to note with respect to these results. The first is that the logit model performs particularly poorly relative to the other models. This may reflect the very aggregate nature of the model developed, although there is no reason in principle why any of the other models could not also be applied at a more disaggregate level as well as the logit model, perhaps with similar results.

*Table 3-2*
*ESTIMATION RESULTS, SELECTED MODELS*

| Parameter | Model | | | | | |
|---|---|---|---|---|---|---|
| | A TLCS-2 | B TLCS-1 | C CLCS-2 | D CLCS-1 | E Log-linear | F Logit |
| $(F)\ \lambda_{1,1}$ | –0.2399 | –0.2660 | –0.2626 | –0.1930 | 0.0 | 1.0 |
| $(H)\ \lambda_{1,2}$ | –1.0982 | –0.2660 | –0.0513 | –0.1930 | 0.0 | 1.0 |
| $(D)\ \lambda_{1,3}$ | 0.0298 | –0.2660 | 0.5712 | –0.1930 | 0.0 | 1.0 |
| $\mu_k$ | 35.757 | 8.6862 | 0.0 | 0.0 | 0.0 | 0.0 |
| (Air) $\alpha_{10}$ | 4.7986<br>(3.629) | 0.7288<br>(1.044) | 21.762<br>(5.001) | 0.9343<br>(1.462) | 1.3910<br>(1.695) | 113.00<br>(3.486) |
| (Rail) $\alpha_{20}$ | 5.0241<br>(4.230) | 0.5087<br>(1.124) | 21.115<br>(4.957) | 0.0380<br>(0.097) | 1.0136<br>(1.618) | 112.28<br>(3.459) |
| (Bus) $\alpha_{30}$ | 4.2821<br>(3.761) | –0.3085<br>(–0.793) | 20.354<br>(4.837) | –0.8106<br>(–2.504) | 0.2516<br>(0.452) | 111.76<br>(3.448) |
| (Car) $\alpha_{40}$ | 0.0<br>(–) | 0.0<br>(–) | 0.0<br>(–) | 0.0<br>(–) | 0.0<br>(–) | 0.0<br>(–) |
| $(F)\ \alpha_1$ | –1.8164<br>(–14.13) | –1.7231<br>(–14.96) | –1.8274<br>(–17.09) | –2.2254<br>(–18.70) | –2.9653<br>(–15.57) | $-0.841\times10^{-3}$<br>(–11.31) |
| $(H)\ \alpha_2$ | –0.0153<br>(–5.941) | –0.3932<br>(–5.105) | –0.8358<br>(–4.596) | –0.3605<br>(–4.144) | –1.3148<br>(–5.576) | –0.0141<br>(–9.092) |
| $(D)\ \alpha_3$ | 1.3779<br>(5.735) | 0.4414<br>(5.067) | 13.503<br>(5.368) | 0.1331<br>(5.022) | 0.4221<br>(4.607) | 0.0114<br>(3.521) |
| $L_1(\lambda, \mu)$ | 543.87 | 539.95 | 538.66 | 532.97 | 528.71 | 456.32 |
| $L_1(\hat{\lambda}, \hat{\mu}) - L_1(\tilde{\lambda}, \tilde{\mu})$ | 0 | 3.94 | 5.21 | 10.90 | 15.16 | 87.55 |
| $r^2$ | 0.7301 | 0.7223 | 0.7197 | 0.7079 | 0.6987 | 0.4909 |
| Skewness | 3.155 | 3.331 | 3.268 | 3.466 | 3.731 | 6.888 |
| Kurtosis | 0.566 | 0.711 | 0.624 | 0.765 | 0.990 | 2.667 |
| DF | 0 | 2 | 1 | 3 | 4 | 4 |

**Source:** **Gaudry and Wills (1978).**
**Notes:** **Numbers in parentheses are *t*-statistics; $r^2$ = correlation coefficient; DF = degrees of freedom.**

The second, more general point is that the choice of functional form can have a very dramatic impact on the conclusions drawn from the model. Table 3-3 presents the market share elasticities evaluated at average sample values for fare, time and frequency for the four modes for two of the models developed. As indicated in this table, these elasticities can vary dramatically as a function of λ, which in turn affects the nature of the model functional form. Figure 3-1 further illustrates this point by plotting the CLCS-1 fare and time elasticities as a function of λ.

"Optimal" values of λ for the CLCS-1 and TLCS-1 models are –0.193 and –0.266, respectively.

Linear interpolation of Table 3-3 yields the service elasticity estimates for the two models at optimal λ shown in Table 3-4. These estimates imply that all modes are fare-elastic (with rail and bus modes being very fare-elastic); car and air modes are time-inelastic, while rail and bus modes appear to have time elasticities between approximately –0.8 and –1.1 (depending on model assumed); and all three common carrier modes are frequency-inelastic.

Gaudry and Wills (1979) continued this general form of investigation into model functional form, in this case using a Box–Cox dogit model of the general form:[10]

$$MS_m = \frac{e^{V_m} + \theta_m \Sigma_{m'} e^{V_{m'}}}{(1 + \Sigma_{m'} \theta_{m'}) \Sigma_{m'} e^{V_{m'}}} \qquad [3.9]$$

$$V_m = \beta_{m_0} + \Sigma_k \beta_m [(X_{m_k} + \mu_k)^{\lambda_k} - 1]/\lambda_k \qquad [3.10]$$

where the β terms are parameters of the modal utility functions, the μ and λ terms are, as before, variable transformation parameters controlling the overall functional form, and the θ terms are the dogit parameters that further influence the shape of the overall function. In particular, they alter the modal cross-elasticities relative to the ordinary logit case. One interpretation of these parameters is that they capture "captivity" effects within the travelling population (that is, a certain proportion of the population may only take one mode, regardless of service levels, or may be prevented from taking a given mode o[illegible] accessibility constraints; for example, people without cars generally will not be able to use the car mode for intercity travel).

*Table 3-3*

SERVICE ELASTICITIES,[a] SELECTED MODELS

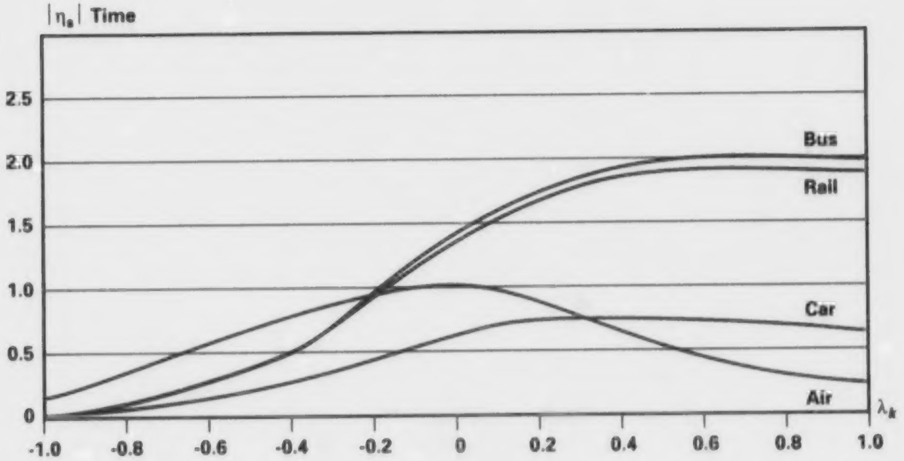
| | Mode-split equation; model CLCS-1; market share elasticities | | | | | | | Mode-split equation; model TLCS-1; market share elasticities | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\mu_k$=0 | Car | | | Air | | | $\mu_k$=10 | Car | | | Air | | |
| $\lambda_k$ | Fare | Time | Frequency | Fare | Time | Frequency | $\lambda_k$ | Fare | Time | Frequency | Fare | Time | Frequency |
| −1.0 | 0.48 | 0.02 | N/A | 0.50 | 0.16 | −0.14 | −1.0 | 0.48 | 0.18 | N/A | 0.49 | 0.83 | −0.32 |
| −0.5 | 1.03 | 0.16 | | 1.31 | 0.61 | −0.24 | −0.5 | 0.88 | 0.51 | | 1.09 | 1.08 | −0.32 |
| −0.2 | 1.25 | 0.37 | | 1.86 | 0.86 | −0.28 | −0.2 | 1.14 | 0.53 | | 1.65 | 0.76 | −0.34 |
| 0 | 1.26 | 0.56 | | 2.07 | 0.92 | −0.29 | 0 | 1.22 | 0.56 | | 1.99 | 0.63 | −0.35 |
| 0.2 | 1.21 | 0.65 | | 2.22 | 0.77 | −0.31 | 0.2 | 1.21 | 0.60 | | 2.33 | 0.53 | −0.35 |
| 0.5 | 1.09 | 0.66 | | 2.37 | 0.48 | −0.32 | 0.5 | 1.09 | 0.63 | | 2.39 | 0.38 | −0.33 |
| 1.0 | 0.82 | 0.56 | | 2.36 | 0.17 | −0.26 | 1.0 | 0.82 | 0.56 | | 2.36 | 0.17 | −0.26 |
| $\mu_k$=0 | Rail | | | Bus | | | $\mu_k$=10 | Rail | | | Bus | | |
| $\lambda_k$ | Fare | Time | Frequency | Fare | Time | Frequency | $\lambda_k$ | Fare | Time | Frequency | Fare | Time | Frequency |
| −1.0 | 1.34 | 0.03 | −0.52 | 1.32 | 0.03 | −0.24 | −1.0 | 1.31 | 0.30 | −0.58 | 1.29 | 0.30 | −0.49 |
| −0.5 | 2.48 | 0.29 | −0.53 | 2.50 | 0.29 | −0.36 | −0.5 | 2.11 | 0.94 | −0.43 | 2.12 | 0.96 | −0.46 |
| −0.2 | 2.84 | 0.75 | −0.46 | 2.91 | 0.77 | −0.40 | −0.2 | 2.55 | 1.09 | −0.37 | 2.61 | 1.12 | −0.46 |
| 0 | 2.74 | 1.21 | −0.39 | 2.83 | 1.26 | −0.40 | 0 | 2.65 | 1.24 | −0.32 | 2.73 | 1.28 | −0.46 |
| 0.2 | 2.53 | 1.52 | −0.33 | 2.64 | 1.59 | −0.40 | 0.2 | 2.53 | 1.45 | −0.28 | 2.64 | 1.50 | −0.43 |
| 0.5 | 2.14 | 1.74 | −0.25 | 2.27 | 1.82 | −0.38 | 0.5 | 2.15 | 1.69 | −0.21 | 2.28 | 1.77 | −0.38 |
| 1.0 | 1.46 | 1.75 | −0.12 | 1.59 | 1.84 | −0.38 | 1.0 | 1.46 | 1.75 | −0.18 | 1.59 | 1.84 | −0.28 |

**Source:** **Gaudry and Wills (1978).**

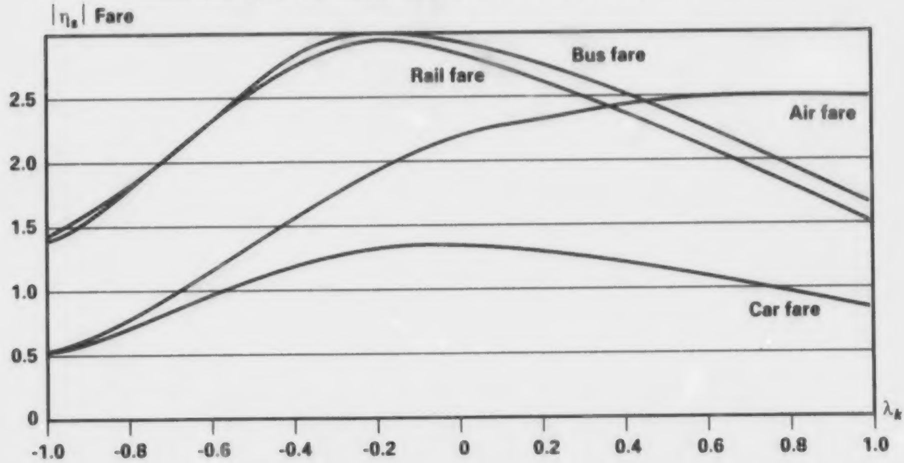
**a.** **By definition, elasticities are completed with the opposite of the sign of the estimated coefficient.**

*Figure 3-1*

## VARIATION IN FARE AND TIME ELASTICITIES WITH FUNCTIONAL FORM, GAUDRY AND WILLS (1978) MODEL CLCS-1



Mode-split equation: model CLCS-1; absolute value of time elasticities.



Mode-split equation: model CLCS-1; absolute value of fare elasticities.

*Table 3-4*

ESTIMATED SERVICE ELASTICITIES AT OPTIMAL $\lambda$ VALUES, SELECTED MODELS

| | Fare | | Time | | Frequency | |
|---|---|---|---|---|---|---|
| | **CLCS-1** | **TLCS-1** | **CLCS-1** | **TLCS-1** | **CLCS-1** | **TLCS-1** |
| Car | 1.25 | 1.08 | 0.38 | 0.53 | N/A | N/A |
| Air | 1.87 | 1.53 | 0.86 | 0.83 | –0.28 | –0.34 |
| Rail | 2.84 | 2.45 | 0.77 | 1.06 | –0.46 | –0.38 |
| Bus | 2.91 | 2.50 | 0.79 | 1.08 | 0.40 | –0.46 |

**Source: Gaudry and Wills (1978).**

As in the previous study, various special case models (including the multiplicative and logit models) were estimated. Table 3-5 presents the estimation results for the six models tested using 1976 observations for 56 Canadian city-pairs (all pairs were within approximately 1,000 miles of one another). In this case general conclusions include the following:

- The dogit model is only very marginally preferable to the logit model in this application.
- Unconstrained use of transformed variables provides little additional explanatory power relative to the more conventional untransformed case. Moreover, transformations do not alter the dogit-logit comparison.
- There is very little difference between the multiplicative and linear exponent (that is, logit) models in terms of model goodness-of-fit.

These results differ significantly from those reported in the same paper for a time-series urban application, in which the dogit model was found to be clearly superior to the logit model. The authors speculated that "a minimum observed market share of 5% for all alternatives may be a rough [lower] bound for the convincing use of logit model the tails of which are often too 'thin' in particular applications."[11] This is perhaps of particular importance in intercity applications where rail and/or bus often constitute "minority" modes within given travel markets and often are found to be poorly modelled by ordinary logit models (see Section 4 for further discussion of this point). Dogit models, on the other hand, are specifically designed to have choice probability distribution-tail thicknesses which vary to fit the observed behaviour and hence might better capture the behaviour of such "minority" modes.

## Table 3-5
## ESTIMATION RESULTS, LOGIT MODEL

| Parameter | | Model variants[a] | | | | | |
|---|---|---|---|---|---|---|---|
| | | DU | DCM | DCL | DEU/LU | LCM | LCL |
| $\theta_1$ car | | $10^{-5}$ | $10^{-5}$ | $10^{-7}$ | 0.000 | 0.0 | 0.0 |
| $\theta_2$ public | | 0.039 | 0.044 | 0.041 | 0.000 | 0.0 | 0.0 |
| $\lambda_k$ | fare | 0.701 | 0.0 | 1.0 | 0.786 | 0.0 | 1.0 |
| | time | 0.233 | 0.0 | 1.0 | 0.362 | 0.0 | 1.0 |
| | frequency | –5.438 | 0.0 | 1.0 | –4.674 | 0.0 | 1.0 |
| $\mu_k$ all variables | | 52.08 | 0.0 | 0.0 | 41.44 | 0.0 | 0.0 |
| Fare | coeff. | –2.394 | –1.924 | –1.530 | –1.855 | –1.545 | –1.130 |
| | *t*-stat. | (–2.34) | (–2.90) | (–1.04) | (–2.06) | (–2.90) | (–0.95) |
| | elast.[b] | –0.77/0.59 | –0.89/0.89 | –0.42/0.28 | –0.62/0.45 | –0.77/0.77 | –0.34/0.23 |
| Time | coeff. | –0.2457 | –1.093 | –10.378 | –2.960 | –1.02 | –9.485 |
| | *t*-stat. | (–8.43) | (–4.67) | (–8.40) | (–9.79) | (–5.43) | (–9.44) |
| | elast.[b] | –0.72/1.04 | –0.50/0.50 | –1.09/3.71 | –0.80/1.32 | –0.51/0.51 | –1.08/3.67 |
| Freq. | coeff. | $17 \times 10^{-12}$ | 0.465 | 26.911 | $22 \times 10^{-11}$ | 0.371 | 21.603 |
| | *t*-stat. | (2.91) | (2.55) | (1.07) | (2.97) | (2.53) | (1.05) |
| | elast. | n.c. | n.c. | n.c. | n.c. | n.c. | n.c. |
| ct car | coeff. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | *t*-stat. | (–) | (–) | (–) | (–) | (–) | (–) |
| ct pub. | coeff. | –1.270 | 1.621 | 29.648 | –1.136 | 1.273 | 23.743 |
| | *t*-stat. | (–3.26) | (127) | (1.00) | (–3.64) | (1.24) | (0.98) |
| $L(\Omega)$ | | 134.52 | 131.78 | 129.95 | 133.31 | 129.69 | 128.56 |
| $L(\Omega) - L(\omega)$ | | 0.0 | 2.74 | 4.57 | 1.21 | 4.83 | 5.96 |
| $r^2$(mean)[c] | | 0.74 | 0.70 | 0.69 | 0.77 | 0.74 | 0.70 |
| $r^2$(origin)[c] | | 0.82 | 0.80 | 0.79 | 0.83 | 0.81 | 0.80 |
| Skewness[d] | | 2.45 | 3.10 | 2.59 | 2.09 | 2.56 | 2.06 |
| Kurtosis[d] | | –0.28 | 0.15 | –0.39 | –0.18 | 0.24 | –0.44 |
| DF | | 0 | 4 | 4 | 1/2 | 6 | 6 |

**Source: Gaudry and Wills (1979).**

**a. In model names, D = dogit, L = logit, C = constrained, U = unconstrained, M = multiplicative, L = linear exponent. Gaudry and Wills (1979) *t*-statistics are computed in each variant for the given values of $\theta$, $\lambda$ and $\mu$.**

**b. The share own and cross-elasticities for alternative 2 (public) are given for market shares assumed to be equal.**

**c. Calculated on variables transformed by $\lambda$ and $\mu$ in model format (13)-(14).**

**d. Skewness and kurtosis for the distribution of errors.**

More recently, Gaudry (1989, 1990) has continued this comparison between logit, dogit and the "inverse power transformation logit," in which transformations are applied to the modal utility functions, rather than to the individual variables within these utility functions. This last approach represents a fairly economical means of developing a very general functional form, since it involves the introduction of only two parameters per mode (one relating to asymmetry effects and one to captivity effects with respect to each mode).

As in the 1978 Gaudry and Wills study, the logit model is found to be inferior to the more generalized forms, using 1976 data for 120 Canadian city-pairs. In particular, significant asymmetry and captivity effects are found which imply that use of an ordinary logit model would under-predict the response to significant rail service level changes.

Finally, a somewhat similar exercise was presented in Oum and Gillen (1983) in which a very generalized utility function (in this case the translog reciprocal indirect utility function) was used to derive a system of "average expenditure share" functions for five expenditure sectors: aggregate goods, aggregate services (excluding intercity travel services), and intercity air, rail and bus services. This system of expenditure share functions was estimated using Canadian time-series data constructed for the period 1961–1976, for a set of assumed parameter restrictions, corresponding to a range of hypotheses concerning travel behaviour.

In assessing these modelling results one should note that this model differs in several important ways from all other models discussed in this paper. First, the dependent variables are shares of expenditures, not trip shares. Second, the model is by far the most aggregate of all models considered in this paper in that it considers total Canadian expenditures, without any level of spatial disaggregation (for example, by origin-destination city-pair, which is the norm in other models considered here). Finally, price is the only modal characteristic which enters the model, meaning that the model cannot be used to assess the impact of level-of-service changes, impute values of time, etc. This also raises the question of the impact of supply-side changes — such as changes in travel times, frequencies, etc. — on model results, given the extended time period over which the model is applied.

In general, the estimation results indicated strong support for the most general model developed. In particular, it implied that the intercity travel sector should not be modelled independently of other economic sectors and that "the current common use of homothetic functional forms such as log-linear models cannot be justified."[12]

Table 3-6 presents the price and income elasticities computed by Oum and Gillen using the generalized model for selected years in their time-series. In general, these results indicate that all three modes are price-elastic. They also indicate that air price elasticities declined slightly over the study period, while rail price elasticities increased at a more significant rate. The negative bus cross-elasticities are explained on the basis of the complementary nature of this mode relative to the other two (an explanation which leaves this reviewer less than fully convinced).

In summary, the various modelling exercises reviewed in this section all point to the need to use more generalized functional forms than those typically used in "operational" intercity travel demand models. In particular, the "ordinary" multinomial logit model with its large number of fairly rigid assumptions concerning functional form, cross-elasticities, etc., seems to be routinely dominated by more general model forms. This is a particularly important point given, as discussed in the next section, the prominent role the multinomial logit model has played (and continues to play) in intercity demand modelling.

The impact of this conclusion, however, is weakened by the unfortunately high level of aggregation adopted in every one of the studies cited above. The Oum and Gillen study, as already noted, is the most extreme in this regard (the omission of the very important car mode from the Oum–Gillen model is also potentially troublesome). In general, however, all the models reviewed above have not disaggregated the travel market at least into business and non-business travel, typically due to data deficiencies. As is clear from the disaggregate modelling results presented in the next section, however, this market segmentation into business and non-business travel is fundamental to achieving an adequate representation of intercity travel demand, given the clearly different variables, elasticities, etc., associated with each of these markets. Further, it may well be that more extensive market segmentation (by trip distance, party size, etc.) may also be equally important to model development.

*Table 3-6*

### PRICE AND INCOME ELASTICITIES FOR TRAVEL DEMAND, OUM–GILLEN MODEL

| Year | Quarter | Air | | | | | | Bus | | | | | | Rail | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $E_{11}$ | $E_{12}$ | $E_{13}$ | $E_{14}$ | $E_{15}$ | $E_{1y}$ | $E_{22}$ | $E_{21}$ | $E_{23}$ | $E_{24}$ | $E_{25}$ | $E_{2y}$ | $E_{33}$ | $E_{31}$ | $E_{32}$ | $E_{34}$ | $E_{25}$ | $E_{3y}$ |
| 1961 | 1 | –1.2815 | –0.0185 | 0.0311 | 1.0797 | –2.1753 | 2.3645 | –1.4168 | –0.0757 | –0.3176 | –0.5064 | 0.2888 | 2.0278 | –1.1051 | 0.1062 | –0.2274 | –0.0099 | 0.6473 | 0.5889 |
| | 2 | –1.2537 | –0.0165 | 0.0280 | 0.9691 | –1.9605 | 2.2335 | –1.3885 | –0.0701 | –0.2962 | –0.4771 | 0.2736 | 1.9584 | –1.0927 | 0.0946 | –0.2002 | –0.0173 | 0.5779 | 0.6377 |
| | 3 | –1.1764 | –0.0112 | 0.0195 | 0.6621 | –1.3641 | 1.8700 | –1.2747 | –0.0471 | –0.2101 | –0.3590 | 0.2121 | 1.6787 | –1.0804 | 0.0831 | –0.1732 | –0.0247 | 0.5090 | 0.6861 |
| | 4 | –1.3165 | –0.0209 | 0.0350 | 1.2185 | –2.4451 | 2.5291 | –1.4280 | –0.0780 | –0.3262 | –0.5182 | 0.2949 | 2.0554 | –1.1123 | 0.1129 | –0.2433 | –0.0056 | 0.6879 | 0.5603 |
| 1964 | 1 | –1.2453 | –0.0160 | 0.0271 | 0.9357 | –1.8957 | 2.1942 | –1.4424 | –0.0809 | –0.3371 | –0.5332 | 0.3028 | 2.0908 | –1.1223 | 0.1223 | –0.2651 | 0.0001 | 0.7437 | 0.5211 |
| | 2 | –1.2247 | –0.0145 | 0.0248 | 0.8539 | –1.7368 | 2.0973 | –1.3992 | –0.0722 | –0.3043 | –0.4884 | 0.2795 | 1.9846 | –1.1044 | 0.1056 | –0.2259 | –0.0105 | 0.6436 | 0.5916 |
| | 3 | –1.1615 | –0.0102 | 0.0179 | 0.6031 | –1.2496 | 1.8003 | –1.2773 | –0.0475 | –0.2120 | –0.3618 | 0.2136 | 1.6851 | –1.0885 | 0.0906 | –0.1908 | –0.0200 | 0.5542 | 0.6545 |
| | 4 | –1.2768 | –0.0181 | 0.0306 | 1.0607 | –2.1388 | 2.3424 | –1.4332 | –0.0790 | –0.3301 | –0.5238 | 0.2979 | 2.0682 | –1.1286 | 0.1282 | –0.2790 | 0.0038 | 0.7792 | 0.4962 |
| 1968 | 1 | –1.1911 | –0.0122 | 0.0211 | 0.7205 | –1.4778 | 1.9395 | –1.4115 | –0.0746 | –0.3136 | –0.5013 | 0.2863 | 2.0148 | –1.1608 | 0.1583 | –0.3496 | 0.0230 | 0.9597 | 0.3694 |
| | 2 | –1.1814 | –0.0116 | 0.0201 | 0.6822 | –1.4034 | 1.8942 | –1.3907 | –0.0704 | –0.2979 | –0.4798 | 0.2751 | 1.9637 | –1.1319 | 0.1313 | –0.2862 | 0.0056 | 0.7979 | 0.4832 |
| | 3 | –1.1385 | –0.0086 | 0.0154 | 0.5118 | –1.0725 | 1.6924 | –1.2897 | –0.0500 | –0.2214 | –0.3750 | 0.2206 | 1.7156 | –1.1101 | 0.1109 | –0.2383 | –0.0073 | 0.6757 | 0.5692 |
| | 4 | –1.2187 | –0.0141 | 0.0242 | 0.8300 | –1.6908 | 2.0694 | –1.4365 | –0.0796 | –0.3326 | –0.5274 | 0.2999 | 2.0762 | –1.1737 | 0.1703 | –0.3779 | 0.0305 | 1.0320 | 0.3186 |
| 1972 | 1 | –1.1686 | –0.0107 | 0.0186 | 0.6307 | –1.3041 | 1.8340 | –1.4794 | –0.0882 | –0.3651 | –0.5724 | 0.3235 | 2.1817 | –1.2820 | 0.2717 | –0.6157 | 0.0948 | 1.6296 | –0.1084 |
| | 2 | –1.1583 | –0.0099 | 0.0175 | 0.5899 | –1.2248 | 1.7856 | –1.4526 | –0.0828 | –0.3448 | –0.5446 | 0.3090 | 2.1158 | –1.2079 | 0.2024 | –0.4530 | 0.0505 | 1.2241 | 0.1838 |
| | 3 | –1.1237 | –0.0075 | 0.0137 | 0.4526 | –0.9579 | 1.6229 | –1.3140 | –0.0548 | –0.2398 | –0.4007 | 0.2341 | 1.7753 | –1.1559 | 0.1538 | –0.3388 | 0.0194 | 0.9327 | 0.3887 |
| | 4 | –1.1856 | –0.0118 | 0.0205 | 0.6982 | –1.4353 | 1.9139 | –1.5282 | –0.0981 | –0.4021 | –0.6232 | 0.3430 | 2.3017 | –1.3429 | 0.3286 | –0.7494 | 0.1312 | 1.9809 | –0.3484 |
| 1976 | 1 | –1.1475 | –0.0092 | 0.0163 | 0.5474 | –1.1421 | 1.7351 | –1.5517 | –0.1029 | –0.4198 | –0.6473 | 0.3624 | 2.3595 | –1.4511 | 0.4297 | –0.9870 | 0.1961 | 2.5871 | –0.7749 |
| | 2 | –1.1436 | –0.0089 | 0.0159 | 0.5319 | –1.1121 | 1.7168 | –1.5198 | –0.0964 | –0.3956 | –0.6143 | 0.3453 | 2.2809 | –1.2770 | 0.2670 | –0.6048 | 0.0919 | 1.6116 | –0.0887 |
| | 3 | –1.1163 | –0.0071 | 0.0129 | 0.4234 | –0.9015 | 1.5885 | –1.3495 | –0.0621 | –0.2668 | –0.4377 | 0.2534 | 1.8627 | –1.1911 | 0.1867 | –0.4161 | 0.0404 | 1.1301 | 0.2499 |
| | 4 | –1.1736 | –0.0110 | 0.0192 | 0.6507 | –1.3431 | 1.8578 | –1.6152 | –0.1157 | –0.4679 | –0.7135 | 0.3970 | 2.5154 | –1.5377 | 0.5180 | –1.1772 | 0.2475 | 3.0729 | –1.1164 |

**Source:** Oum and Gillen, 1983.

**Note:** Subscripts: 1 = air, 2 = bus, 3 = rail, 4 = goods, 5 = services, *y* = income.

Thus, the relative importance of using significantly more general functional forms in intercity demand modelling will remain difficult to determine until the sort of structured hypothesis testing represented by the Gaudry-Wills and Oum-Gillen efforts are repeated within richer data sets that permit appropriate market segmentation. This would appear to be an eminently worthwhile undertaking, particularly since it is so very rarely done with "normal" demand modelling efforts which all too typically make relatively arbitrary designs concerning model functional form at the outset of the modelling process and never revisit or test these assumptions anywhere within that process.

These important caveats concerning model aggregation/market segmentation aside, one should not lose sight of the very general, very consistent conclusion reached by these studies — that the simple multinomial logit model is likely to have difficulty in modelling "minority" (that is, small-share) modes and is almost certainly making overly strong assumptions concerning the nature of modal share elasticities, particularly cross-elasticities. As is made clear by the discussion of multinomial logit models of intercity mode choice in the next section, these concerns do seem to be verified by the experience gained with these models. As is also discussed in Section 4, other generalizations of the multinomial logit model are possible. In general, these consist of various forms of "nested" or "structured" decision structures that provide more complex elasticity structures while essentially retaining the analytical and computational simplicity of the logit model. As is discussed in subsequent sections, selection from among these various approaches (for example, generalized functional form versus generalized decisions structure versus market segmentation) may well require further systematic research similar in nature to that reviewed in this section, but applied within a broader conceptual context and within a richer empirical environment.

# 4. DISAGGREGATE INTERCITY TRAVEL DEMAND MODELS

## 4.1 INTRODUCTION

This section begins with a brief overview in subsection 4.2 of the disaggregate choice approach to modelling travel demand. Subsection 4.3 then presents a summary review of early non-Canadian disaggregate modelling efforts. All major Canadian disaggregate intercity mode-split models reported in the literature during the past 20 years are then reviewed in some detail in subsections 4.4 and 4.5. These models can be grouped into two relatively distinct categories: multinomial logit models based on revealed preference data (that is, models are estimated using observations of actual mode choices made by actual travellers within the intercity passenger system) and "structured" binary logit models based on stated preference data (that is, models are estimated based on the choices of travellers who have been asked to state the choice they would make within a hypothetical but realistic situation). Subsection 4.4 discusses the first group (the revealed preference models), while subsection 4.5 discusses the second group (stated preference models). In addition to the Canadian models discussed in subsections 4.4 and 4.5, promising recent U.S. modelling efforts based on both revealed and stated preferences are also discussed.

## 4.2 OVERVIEW OF DISAGGREGATE CHOICE MODELS[13]

As discussed at some length in Section 2, modelling trip-making at the disaggregate level of the individual trip-maker has many conceptual advantages relative to the more traditional modelling of aggregate city-to-city flows. The dominant operational disaggregate mode choice model is the multinomial logit model which has the general functional form:

$$P_{it} = e^{V_{it}} / \sum_{j \in C_t} e^{V_{jt}} \qquad [4.1]$$

$$V_{it} = \beta' \mathbf{X}_{it} \qquad [4.2]$$

where:

$P_{it}$ = probability that individual $t$ chooses alternative $i$ from the set of feasible alternatives, $C_t$

$V_{it}$ = systematic utility of alternative $i$ for individual $t$

$\mathbf{X}_{it}$ = vector of explanatory variables, consisting of attributes of alternative $i$ (travel time, cost, etc.) and the decision-maker $t$ (income, occupation, etc.)

$\beta$ = vector of model parameters or coefficients (the prime indicates the transpose operator, thus $\beta' \boldsymbol{X}_{it}$ represents the dot product of two column vectors, $\beta$ and $\boldsymbol{X}_{it}$)

The modal utility function $V_{it}$ need not be linear in the parameters as shown in equation [4.2]. In practice, however, it generally is, since this assumption greatly simplifies the model estimation process. Note that $X_{it}$ can include non-linear combinations of explanatory variables (for example, travel cost divided by income) as well as dichotomous "dummy" variables (for example, equal to one in value if individual *t* belongs to a given occupation group, equal to zero in value otherwise) without violating this linear-in-the-parameters property.

Given equations [4.1] and [4.2], the general forms of logit model mode share direct and cross-elasticities can be derived. These are:

$$e_{iik} = \beta_k X_{ik}(1 - P_i) \qquad [4.3]$$

$$e_{ijk} = -\beta_k X_{jk} P_j \qquad [4.4]$$

where $X_{ik}$ is the value of the *k*th variable for mode *i*, and the subscript *t* denoting the individual has been dropped for simplicity of presentation from both the *X* and *P* variables.

These elasticities are similar to those found for the CTC model (see subsection 3.2), with the additional dependence on the level of the variable being changed (that is, $X_{ik}$ or $X_{jk}$). As with the CTC model, cross-elasticities are constant across the "unchanged" modes, and both direct and cross-elasticities vary linearly with modal share (ignoring the effect of the *X* terms) in the same way as for the CTC model. Generally, the actual magnitudes of the elasticities will depend critically on the magnitude of the product $\beta_k X_{ik}$.

The constant cross-elasticity assumption inherent in multinomial logit models represents the single biggest weakness of the modelling method. It means that improvement in one mode (or the introduction of a new mode) will result in a diversion of trips to the changed or new mode in fixed proportions from all other modes available. This characteristic is often referred to as the "independence of irrelevant alternatives" (IIA) property. One of the simplest ways of expressing the IIA property is to note that the ratio of choice probabilities for two modes *i* and *j* is given by:

$$P_{it}/P_{jt} = e^{V_{it}}/e^{V_{jt}} = e^{(V_{it} - V_{jt})} \qquad [4.5]$$

That is, the ratio of choice probabilities for any two modes in the choice set depends only on the systematic utilities of the two modes and not in any way on what other modes are in the choice set or on the characteristics of these other modes. In other words, these other modes are "irrelevant" to probability ratio ($P_{it}/P_{jt}$).

Thus, for example, if the rail mode is upgraded significantly the logit model will predict that trips diverted to the new rail service will consist of the same proportion of trips from each of the competing modes (presumably car, air and bus). The car/air and car/bus probability ratios (or any other ratio combination for these three modes) remain constant, as required by equation [4.5]. A real intercity travel market, however, is *not* likely to behave in this way. In practice, the improved rail mode will likely attract greater or fewer proportions of trips from competing modes, depending on the price/time/service combination offered. (A very high-speed, high-cost rail service presumably might divert air trips primarily; a high-speed, moderately priced service might divert car trips primarily; etc.) Hence the logit model predictions might significantly over- or underestimate modal diversion because of its IIA assumption (or equivalent constant cross-elasticity assumption).

If this IIA assumption proves to be untenable in a given application, then a more complex choice model is required. In current practice this typically means using some form of structured or nested logit model. These models are discussed in more detail in subsections 4.4.6 and 4.5, where examples of intercity passenger demand models of this form are presented.

Generally, coefficients or parameters of multinomial logit models are statistically estimated using maximum likelihood estimation (MLE) based on the observed choices made by a sample of actual trip-makers within the system being modelled. This sample can be drawn either from travellers found on each mode in the system (that is, a random sample is drawn from rail passengers, bus passengers, etc.) or from a set of households or individuals selected at random from the population at large (in which case information about the household's recent intercity travel behaviour is usually obtained).

In the first case, the choice-based sample must be weighted appropriately to obtain unbiased model parameter estimates (Manski and Lerman, 1977). Subsections 4.3 and 4.4 discuss various models which have been developed with revealed preference data and include ones developed using both choice-based and household-based survey data.

As briefly noted in the introduction, disaggregate models can also be estimated using stated preference data obtained by asking a selected group of people to make choices within hypothetical choice contexts. For example, "*if* the relative times, costs, etc., for these two modes were such and such, which mode *would* you choose?" Subsection 4.5 reviews the historical evolution of Canadian models based on stated preference data. These models are of particular importance to this report since they represent the main method used by VIA Rail during the past decade to project intermodal competition within the Canadian intercity travel market.

## 4.3 SUMMARY OF EARLY NON-CANADIAN MODELS[14]

Perhaps the earliest application of the multinomial logit model to intercity passenger mode choice modelling (although using aggregate data) is by Ellis et al. (1971). Watson (1972, 1974) developed a rail versus car, binary logit model for the Glasgow–Edinburgh corridor, while Leake and Underwood (1978) developed rail versus air, binary logit models for work and non-work purposes for the London–Manchester and London–Glasgow corridors. Parameter values for the two corridors were found to be quite similar, except that a positive rail bias existed in the London–Manchester corridor, whereas an air bias existed in the longer London–Glasgow corridor. Binary logit models comparing rail individually with car, bus and air were developed for the Buffalo–Albany–New York City corridor and then combined to estimate rail ridership impacts of energy-related transportation policies (Cohen et al., 1978).

One of the first applications of disaggregate multinomial logit models to intercity passenger mode choice was the Stopher and Prashker (1976) model, developed using the 1972 National Travel Survey (NTS). Although statistically significant, plausibly signed parameter estimates were obtained for business and non-business models. Counter-intuitive elasticities and very poor replication of mode shares in selected corridors were also obtained. These poor results were blamed on the data base used although, as Koppelman et al. (1984) pointed out, model specification problems also appear to have existed. In particular, the level of service variables were all expressed as ratios relative to average values. This appears to be a holdover from some of the earlier aggregate model formulations, with little behavioural rationale, especially within a disaggregate logit model formulation.

Grayson (1981) achieved significantly improved results using the 1977 NTS data and an improved model specification (for example, inclusion of income and deletion of the relative value formulation of service variables).

Stephanedes et al. (1984) estimated a three-mode model (bus, plane and car) for the Twin Cities–Duluth corridor. This model had very high alternative specific constants and generated very high bus travel time and fare elasticities (–2.0 and –4.0, respectively). Again, these results can be attributed to methodological weaknesses in the model's development — in this case including the use of a very small, non-random sample and the mixing of reported and estimated service variables (for the chosen and unchosen modes respectively).

Finally, Morrison and Winston (1983) developed the first nested logit model of intercity passenger travel choice. It consisted of three stages: destination, mode and the decision to rent a car at the destination end. Data from the 1977 NTS were used to estimate the model. A more detailed discussion of the nested logit model is presented in subsection 4.4.6.

## 4.4 CANADIAN REVEALED PREFERENCE MODELS

Five multinomial logit models of Canadian intercity passenger mode choice have been developed and reported in the literature over the past 20 years. These are (in chronological order of model development):

- the TDA model, developed for the Ottawa–Montreal corridor using 1972 survey data specially collected for the project;
- the Ridout–Miller model, developed using the 1969 CTC data base for the Windsor–Quebec City corridor;
- the Wilson et al. model, developed using 1984 Canadian Travel Survey (CTS) data for Canada-wide intercity travel;

- the Abdelwahab et al. model, developed using the same 1984 CTS data base as the Wilson et al. model; and
- the PM model, developed by KPMG Peat Marwick for the Ontario/Quebec Rapid Train Task Force using 1988 VIA Rail data for the Windsor–Quebec City corridor.

Each of these models is discussed in the following subsections. In addition, Koppelman's work at Northwestern University through much of the 1980s is representative of recent U.S. efforts in this area and is reviewed in some detail subsection 4.4.6.

### 4.4.1 The TDA Model[15]

This model was developed specifically for the Ottawa–Montreal corridor using 1972 data specially collected for the study. The mode choice data were collected using on-board surveys for the air, rail and bus modes and a roadside interview for the car mode. The project report does not contain any discussion of the weighting procedure used to adjust logit model estimation results for the choice-based data collection approach used.

This study's most significant contribution relates to the very detailed statistical examination of the role a wide range of service variables play in explaining intercity mode choice (at least in 1972 in the Ottawa–Montreal corridor). The on-board and roadside surveys collected information on a wide range of modal service characteristics and the attitudes and perceptions of the trip-makers with respect to these characteristics. Prior to developing the multinomial logit model, an intensive analysis of these data was undertaken. This included factor analyses to determine the primary dimensions affecting modal choice; discriminant analyses to determine the variables which best discriminate, or identify, users of each mode; and contingency table, regression and linear programming analyses designed to check the discriminant analysis results. General conclusions from this study include the following:

- The self-reported rankings of how important 24 different variables were in influencing the choice of mode of travel, based on the percentage of "very important" or "fairly important" responses for each variable, are as shown in Table 4-1.

- Factor analyses of these importance rankings and the ratings of all four modes with respect to 18 modal attributes indicate that the two most important factors in modal choice are a "comfort" dimension and a "time and schedule" dimension.
- Discriminant analyses indicate that many of the variables which best discriminate between modal groups are often not ranked highly in importance by travellers. For example, by far the best three discriminating variables overall were "availability of car at destination" (ranked eighth overall in importance), "able to work en route" (ranked 18th overall in importance) and "availability of food" (ranked 11th overall in importance). Conversely, "safety" (ranked fourth in overall importance) had the fourth lowest discriminant coefficient of the 24 variables considered. (It is noted that 75 percent of the market analyzed belongs to the car mode, by far the least safe of the available modes.) Similarly, the three highest ranked variables, "schedule," "confidence of arriving on time" and "travel time," possessed discriminant coefficients which were half the magnitude of the three best discriminating variables listed above.
- Starting with the 18 modal attributes mentioned in the second point above, plus a wide range of time, cost and frequency measures, the best-fitting logit models for business and pleasure trips were found to consist of:
  - access plus egress time;
  - perceived door-to-door time (ranked from "very poor" to "very good" using a seven-point scale);
  - perceived convenience of departures (seven-point scale); and
  - door-to-door cost per person (for the "pleasure" model only).
- No attempt was made within the study to investigate the effect of traveller socio-economic characteristics (income, etc.) on intercity modal choice.

*Table 4-1*

RANK ORDERING OF FACTORS AFFECTING MODE CHOICE, TDA STUDY

| Rank order | Variable no. | Variable definition |
|---|---|---|
| 1 | 2 | Schedule |
| 2 | 3 | Confidence of arriving on time |
| 3 | 1 | Travel time |
| 4 | 7 | Safety |
| 5 | 8 | Minimum of advance arrangements |
| 6 | 11 | Fatigue |
| 7 | 5 | Sitting comfort |
| 8 | 23 | Car at destination |
| 9 | 14 | Ability to relax en route |
| 10 | 10 | Freedom from noise |
| 11 | 21 | Food availability |
| 12 | 4 | Cost |
| 13 | 12 | Privacy |
| 14 | 16 | Ease of luggage handling |
| 15 | 18 | Pleasant interior |
| 16 | 20 | Credit card |
| 17 | 24 | Car left for family |
| 18 | 13 | Work en route |
| 19 | 19 | Special smokers' section |
| 20 | 22 | Personalized service |
| 21 | 6 | Terminal comfort |
| 22 | 15 | Amount of luggage |
| 23 | 9 | Seeing the country |
| 24 | 17 | Meeting interesting people |

### 4.4.2 The Ridout–Miller Model[16]

This model was developed using the 1969 CTC data base for common carrier usage in the Windsor–Quebec City corridor. This choice-based data base required appropriate weighting of the observations during the parameter estimation process. As has been discussed, it did not contain any information on car trips (the single biggest component of the corridor's travel), thus limiting the ultimate policy sensitivity of the model. The main objectives of this modelling exercise were to gain experience in the application of disaggregate logit models to the intercity mode-choice problem and to investigate differences in travel behaviour across different trip purposes.

Given the latter objective, three models were developed, one for each of the following trip purposes: business, pleasure (combination of visit friends and relatives, vacation, and shopping and entertainment), and personal (combination of personal business and other). A wide variety of functional specifications were investigated for each model. Table 4-2 summarizes the results of this model estimation exercise in terms of the variables included in the final "best" specification of each model[17] and the model parameter values estimated for each variable in each model. Note that the systematic utility functions for each of the modes in the model can be recovered by adding together each of the variables defined in Table 4-2(a), multiplied by their associated parameter values in Table 4-2(b). Thus, for example, the rail-mode utility function in the business model is given by:

$$\begin{aligned} V_{\text{rail}} = {} & 0.2032 - 0.01442^{*}\text{ACC} - 0.004578^{*}\text{EG}_{\text{R}} - 0.03507^{*}(\text{FARE/INC}) \\ & - 0.04029^{*}\text{TIME}_{\text{R}} + 0.6755^{*}d_{\text{R}} \end{aligned} \qquad [4.6]$$

where all variables are as defined in Table 4-2.

Table 4-2 indicates that major differences exist in the functional forms found to best fit the data for the three models. These include the treatment of access and egress times, in-vehicle time, frequency and occupation. In other words, the way in which people evaluate the competing modes and hence how they choose a mode, appears to differ significantly from one trip purpose to another. This is over and above the differences in parameter values found for a given variable for each of the trip purposes.

Table 4-2 shows that the models best fit the data when a composite fare divided by income term is used. This implies that fare elasticities vary systematically with income level (certainly not an unreasonable proposition), given by the following modified versions of equations [4.3] and [4.4]:

$$e^{p}_{ii,\,\text{fare}} = (\gamma_p/Y)F_i(1 - P_i) \qquad [4.7]$$

$$e^{p}_{ii,\,\text{fare}} = -(\gamma p/Y)F_jP_j \qquad [4.8]$$

where $p$ denotes the trip purpose, $Y$ is the trip-maker's income (in this case represented by an index that ranges from 1 to 9 — low to high — in value), and $F_i$ is the fare for mode $i$.

Given the estimated coefficient values, pleasure and personal travellers have cost elasticities which are 9.1 and 7.5 times greater, respectively, than the cost elasticity for business travellers for comparable values of modal service levels and traveller characteristics. These results are qualitatively consistent with prior expectations (that is, business travel should be much less cost sensitive than other types of intercity travel).

Again, consistent with prior expectations, pleasure and personal travellers are found to have travel time elasticities with a smaller order of magnitude than business travellers using the air mode (0.097 and 0.12 times smaller, respectively) and three to four times smaller than business travellers using the rail or bus modes (0.26 and 0.32 times smaller, respectively). This, in turn, implies that air business travellers have time elasticities that are over two and one half (2.67) times as large as bus and rail business travellers — again a reasonable result.

*Table 4-2*
*ESTIMATION RESULTS, RIDOUT–MILLER MODEL*

| **(a) Independent variables** | | |
|---|---|---|
| **Category** | **Variable** | **Description** |
| Level of service variables (for mode *M*; *M* = A, R, B for air, rail bus) | $\text{ACC}_M$ | Access distance (km) |
| | $\text{EG}_M$ | Egress distance (km) |
| | $\text{FARE}_M$ | Fare (dollars) |
| | $\text{TIME}_M$ | In-vehicle time (h) |
| | $\text{FREQ}_M$ | Frequency (vehicles/day) |
| | $\text{DIST}_M$ | Air travel distance (km) |
| Socio-economic variables | INC | Household income |
| | AGE | Age of respondent |
| | SEX | Sex of respondent |
| | JOB | Occupation of respondent |
| | IND | Industry of respondent |
| | EDUC | Education level |
| Alternative-specific variables | $D_A$ | 1 for car mode; 0 otherwise |
| | $D_R$ | 1 for rail mode; 0 otherwise |
| | $d_{A1}$ | 1 if the traveller is in the manufacturing, construction, retail or wholesale industry, for the air mode; 0 otherwise |
| | $d_{A2}$ | 1 if the traveller is in the finance, insurance, real estate, or "other" industry, for the air mode; 0 otherwise |
| | $d_{R1}$ | 1 if the traveller is in the medical or government services, for the rail mode; 0 otherwise |

*Table 4-2 (cont'd)*

## ESTIMATION RESULTS, RIDOUT–MILLER MODEL

| (b) The final models | | | | | | |
|---|---|---|---|---|---|---|
| **Variable** | **Business** | | **Pleasure** | | **Personal** | |
| $D_A$ | −0.3391 | (1.79) | −1.918 | (6.78) | −2.187 | (8.13) |
| $D_R$ | 2.2032 | (1.60) | 0.1677 | (1.41) | 0.2332 | (1.44) |
| ACC/DIST | | | | | −7.922 | (4.49) |
| ACC | −0.01442 | (2.41) | | | | |
| $ACC_A$/DIST | | | | (5.36) | | |
| $ACC_R$/DIST | | | −14.42 | (3.05) | | |
| $ACC_B$/DIST | | | −5.283 | (8.49) | | |
| EG/DIST | | | −15.59 | (1.49) | | |
| $EG_A$ | −0.06210 | (6.85) | −2.052 | | | |
| $EG_R$ | −0.004578 | (0.61) | | | | |
| $EG_B$ | −0.03612 | (2.75) | | | | |
| FARE/INC | −0.03507 | (8.61) | −0.3201 | (11.73) | −0.2616 | (9.91) |
| TIME | | | −0.01044 | (10.76) | −0.01275 | (9.32) |
| $TIME_A$ | −0.1075 | (7.91) | | | | |
| $TIME_R$ | −0.04029 | (15.60) | | | | |
| $TIME_B$ | −0.04029 | (15.60) | | | | |
| log (FREQ) | | | 1.469 | (6.43) | 1.403 | (4.62) |
| $d_{A1}$ | 0.8612 | (6.99) | | | | |
| $d_{A2}$ | 0.2715 | (2.88) | | | | |
| $d_R$ | 0.6755 | (5.16) | | | | |
| % right | | 83.9 | | 48.4 | | 45.6 |
| $\rho^2$ | | 0.703 | | 0.171 | | 0.176 |
| No. of observations | | 2,497 | | 2,551 | | 1,082 |
| No. of cases[a] | | 4,994 | | 5,102 | | 2,164 |

**a. The number of cases equals the number of unchosen alternatives for each observation, summed over the total number of observations.**

If $\alpha_{ip}$ and $\gamma_{ip}$ are the time and fare parameters for mode *i* and purpose *p*, respectively, then the Ridout–Miller model implies that the value of time $VOT_{ip}$ (1969 Can.$/hour) for travellers using mode *i* for purpose *p* is given by:

$$VOT_{ip} = (\alpha_{ip}/\gamma_{ip})^{*}Y \qquad [4.9]$$

Given the model parameter values shown in Table 4-2, equation [4.9] implies VOTs that range from $3.07 to $27.63 for air business travellers (as income ranges from the lowest to highest category), $1.15 to $10.35 for rail and bus business travellers, and $0.03 to $0.30 and $0.05 to $0.44 for pleasure and personal purposes, respectively.

As discussed in Ridout and Miller (1989), the lack of a significant, correctly signed frequency term in the business model is certainly unexpected and disappointing, but is most likely due to the relative invariance in observed frequencies in the estimation data set, especially given the extent to which Toronto–Montreal trips dominate the business trip sample.

This lack of sufficient variability in observed modal service variables is a recurring problem in intercity demand modelling using revealed preference data, due to the relatively small number of origin-destination pairs in most corridor-oriented data sets. For example, the CTC data set originally had 34 city-pairs; Ridout and Miller were able to use only four of these city-pairs due to lack of disaggregate access/egress information for other cities in the corridor. This lack of variability is also due to the fact that most level-of-service attributes vary only on a city-pair basis and not from observation to observation for a given city-pair. The Koppelman model discussed in subsection 4.4.6 below manifests similar data-related problems in that the business model also fails to achieve a correctly signed, statistically significant frequency term. In addition, Koppelman was forced to estimate cost and travel time terms jointly by constructing a "generalized cost" term using assumed values of time to avoid collinearity problems largely caused by this lack of variability.

The final point to note from Table 4-2 is that despite extensive investigations, socio-economic variables (over and above income) play little role in explaining modal choice within the corridor. In particular, the occupation-related variables included in the business model appear to have little substantive theoretical rationale.

Two final points should be made with respect to this model. First, examination of prediction success tables constructed by comparing the model's expected predicted mode choices for the sample versus the actual observed choices indicates that the model is unable to distinguish effectively between the rail and bus modes, which typically have very similar travel times and costs for most observations. Indeed, on several links the rail service typically may cost more, provide less-frequent service and take approximately the same time and yet attract a higher modal share than the competing bus service. This phenomenon is reflected in the relatively large modal constant for rail in each of the models developed, which indicates that the observed rail mode split is underestimated by the model based on the variables included in the model (essentially travel time, cost and frequency). This observed modal split depends in a systematic way on other factors not included in the model.

The second point is that the overall goodness-of-fit of these models is not very good. The expected percent right and $\rho^2$ values for the business model look very impressive, but ultimately these are a function of the fact that the air mode dominates the business market in this sample and hence the model can achieve a good fit by predicting that most trips go by air, without really discriminating between the various modal usages that actually occur. The corresponding statistics for the pleasure and personal modes are quite low by normal logit model standards (a comparable urban mode-split model — if such a comparison is meaningful — might be expected to have a $\rho^2$ of the order of 0.35 to 0.40 and an expected percent right of 60 or better[18]). These low goodness-of-fit statistics indicate that there is considerable uncertainty relating to modal choice which has been left unexplained by these models.

### 4.4.3 The Wilson et al. Model[19]

This model is estimated using 1984 Canadian Travel Survey (CTS) data. CTS is a home interview survey conducted periodically since 1977 by Statistics Canada to collect information on long-distance travel behaviour of Canadians. Wilson et al. used the 1984 survey data to develop four-mode models (air, rail, bus and car) for eastern and western Canada (Thunder Bay is the westernmost city included in the eastern region) for business and non-business trip purposes. (Models, however, are only reported for the eastern business and western non-business cases.)

Table 4-3 presents the variable definitions and coefficient estimates obtained for the eastern business model and the western non-business model, while Table 4-4 compares the results for the eastern business model with those obtained in the Ridout–Miller business model. From Table 4-4 it can be readily seen that the Wilson et al. model has a very different functional specification from the Ridout–Miller model.[20] Perhaps the most striking of these differences is that in the Wilson et al. model, income enters as an alternative-specific, stand-alone variable rather than interacting with travel cost (as in the Ridout–Miller model). These two approaches represent quite different hypotheses with respect to the effect of income on modal utilities

*Table 4-3*

ESTIMATION RESULTS, WILSON ET AL. MODEL

| Variable No. | Variable definition | Model for business trips: eastern region | | | Model for non-business trips: western region | | |
|---|---|---|---|---|---|---|---|
| | | **Parameter estimate** | **Asymptotic standard error** | **t-statistic value error** | **Parameter estimate** | **Asymptotic standard** | **t-statistic value** |
| 1 | Constant specific to the bus utility function | 16.596 | 3.965 | 4.18 | 1.362 | 1.902 | 0.72 |
| 2 | Constant specific to the rail utility function | 18.016 | 4.282 | 4.20 | –0.593 | 2.137 | –0.18 |
| 3 | Constant specific to the air utility function | 15.382 | 4.332 | 3.55 | 0.905 | 1.904 | 0.48 |
| 4 | TTDT (travel time/distance) | –166.285 | 88.960 | –1.86 | –0.037 | 0.006 | –6.47 |
| 5 | TCDT (travel cost/distance) | –15.074 | 7.536 | –2.00 | –10.781 | 1.965 | –5.48 |
| 6 | TF (frequency of service) | 0.018 | 0.004 | 4.27 | 0.0024 | 0.002 | 1.21 |
| 7 | HH income specific to the bus utility function | –0.0000273 | 0.0000282 | –0.96 | –0.0000102 | 0.0000189 | –5.36 |
| 8 | HH income specific to the rail utility function | –0.0000488 | 0.0000350 | –1.39 | –0.0000333 | 0.0000328 | –1.01 |
| 9 | HH income specific to the air utility function | 0.0000588 | 0.0000250 | 2.34 | 0.0000116 | 0.0000828 | –0.14 |
| | | **Log likelihood**<br>At equal share, $L(0) = -195.47$<br>At market share, $L(c) = -146.43$<br>At convergence, $L(\beta) = -90.29$<br>**Likelihood ratio**<br>$-2[L(c) - L(\beta)] = 112.28$<br>**Likelihood ratio index**<br>At zero, $\rho^2(0) = 0.538$<br>Adjusted, $\rho^2(a) = 0.492$<br>At constant, $\rho^2(c) = 0.383$<br>Number of cases = 141 | | | **Log likelihood**<br>At equal share, $L(0) = -1048.00$<br>At market share, $L(c) = -624.12$<br>At convergence, $L(\beta) = -446.32$<br>**Likelihood ratio**<br>$-2[L(c) - L(\beta)] = -355.59$<br>**Likelihood ratio index**<br>At zero, $\rho^2(0) = 0.574$<br>Adjusted, $\rho^2(a) = 0.566$<br>At constant, $\rho^2(c) = 0.285$<br>Number of cases = 756 | | |

**Note:** HH = household.

and, hence, choices. The alternative-specific variable approach represents income as generating a "bias" between the various modes that varies with income (that is, it alters the values of the modal constants across individuals as a function of their incomes), but assumes that the traveller's sensitivity to travel cost per se remains unchanged as income varies.

*Table 4-4*

*Comparison of Ridout–Miller and Wilson et al. Business Models*

| | Model | |
|---|---|---|
| **Variable** | **Ridout–Miller** | **Wilson et al.** |
| Constants | | |
| Bus | — | 16.592 (4.18) |
| Rail | 0.2032 (1.64) | 18.016 (4.20) |
| Air | –0.3391 (1.793) | 15.382 (3.55) |
| Access distance (km) | –0.01442 (2.408) | — |
| Egress distance (km) | | |
| Air | –0.0621 (6.846) | — |
| Rail | –0.004578 (0.612) | — |
| Bus | –0.03612 (2.75) | — |
| Travel time/distance (generic) | — | –166.285 (–1.86) |
| Travel time | | |
| Air | –0.1075 (7.914) | — |
| Rail | –0.04029 (15.60) | — |
| Bus | –0.04029 (15.60) | — |
| Travel cost/distance | — | –15.084 (–2.00) |
| Fare/income | –0.3507 (8.606) | — |
| Frequency | — | 0.018 (4.27) |
| Dummy for employment in manufacturing | 0.8612 (6.992) | — |
| Dummy for employment in finances and other services | 0.2715 (2.282) | — |
| Dummy for employment in medical and government services | 0.6755 (5.163) | — |
| Household income | | |
| Bus | — | –0.0000273 (–0.96) |
| Rail | — | –0.0000488 (–1.39) |
| Air | — | –0.0000488 (2.34) |
| $\rho^2$ | 0.7043 | 0.538 |

**Notes: Numbers in parentheses are *t*-statistics values; dummy variables = 0 or 1.**

This means that fare elasticities will still vary with income, but in a much less dramatic way than in the Ridout–Miller model. That is, equations [4.3] and [4.4] can be used to compute fare elasticities, with changes in income (holding all other factors constant) changing the $P_i$ or $P_j$ terms (that is, the modal share probabilities). The change in elasticity with respect to income is much lower than in the Ridout–Miller model, for which equations [4.7] and [4.8] apply, and in which income enters the elasticity equation directly, as well as having an indirect effect via the probability terms. Further, the direction of the elasticity change with respect to income depends on the relative values of the modal income parameters. Given the parameter values shown in Table 4-3, rail and bus fare elasticities actually *decline* very slightly with increased income, while air fare elasticities increase slightly with income. While one cannot reject this result out of hand, it is not clear that it is consistent with reasonable a priori expectations concerning the effect of income on fare elasticities.

For similar reasons, the Wilson et al. model generates a constant value of time per model (that is, one which does not vary with income). These times, for the two reported models, are $11.02 (1984 Can.$) and $0.003 (1984 Can.$) for the eastern business model and western non-business model, respectively. The business value of time certainly cannot be rejected out of hand; however, the non-business result is surely unreasonable.

The Wilson et al. model interacts both travel time and cost with trip distance. In each case, the relative sensitivity to travel time and cost decreases as distance increases (although these sensitivities vary in the same way with distance so that the value of time does not vary with trip distance). This is not an illogical result, especially given that the *differences* between modal service characteristics determine logit model probabilities. In other words, the Wilson et al. model indicates that a given difference in the travel times or costs between two modes becomes less critical to the modal choice process as trip distance increases (that is, a five-minute travel time difference is less important for a trip of 1,000 kilometres than for a trip of 100 kilometres) — again, a not unreasonable result a priori.

As with the Ridout–Miller model, socio-economic variables other than income did not improve the model's fit of the observed data. Similarly, various "dummy" variables (that is, variables that equal either zero or one) designed to capture effects such as party size, weekend travel, trip duration and trip distance failed to make a significant contribution to the model (a not inconsistent result to the TDA model findings).

Table 4-5 presents prediction success tables for the two reported models. The results are similar to the Ridout–Miller findings in that the models do a very poor job of predicting rail and bus mode shares. In this case they appear to predict virtually zero mode shares — a very poor result indeed! Rail and bus modes are clearly "minority" modes in both models (representing, collectively, only 11 percent and 6 percent of the trips in the two samples). It has often been found that multinomial logit models perform poorly in the prediction of minority modes.

This problem is compounded by the household-based sampling method used. It results, first, in relatively few usable observations overall (in this case 141 and 756, respectively) and, second, in very few observations of minority-mode choices. These problems can be alleviated through use of the choice-based, on-board survey approach (as used in collecting the CTC data base), since both larger samples can be efficiently gathered and minority modes can be oversampled in a statistically valid manner. As is clear from the Ridout and Miller results, sampling methodology alone is not sufficient to resolve the rail-bus prediction problem.

*Table 4-5*

PREDICTION SUCCESS TABLES, WILSON ET AL. MODEL

| | Car[a] | Bus[a] | Rail[a] | Air[a] | Row total (observed trips) | Observed share (%) |
|---|---|---|---|---|---|---|
| **Prediction success table for business trip model: eastern region** | | | | | | |
| Car[b] | 56 | — | — | 13 | 69 | 48.94 |
| Bus[b] | 8 | — | — | 2 | 10 | 7.09 |
| Rail[b] | 4 | — | — | 2 | 6 | 4.25 |
| Air[b] | 6 | — | — | 50 | 56 | 39.72 |
| Column total (predicted trips) | 74 | — | — | 67 | 141 | 100.00 |
| Predicted share (%) | 52.48 | — | — | 47.52 | 100.00 | |
| Percent correctly predicted | 81.16 | — | — | 89.29 | | |
| **Prediction success table for non-business trip model: western region** | | | | | | |
| Car[b] | 473 | — | — | 25 | 498 | 65.87 |
| Bus[b] | 37 | — | — | 2 | 39 | 5.16 |
| Rail[b] | 5 | — | — | 2 | 7 | 0.93 |
| Air[b] | 106 | — | — | 106 | 212 | 28.04 |
| Column total (predicted trips) | 621 | — | — | 135 | 756 | 100.00 |
| Predicted share (%) | 82.14 | — | — | 17.86 | 100.00 | |
| Percent correctly predicted | 94.98 | — | — | 50.00 | | |

a. **Number of predicted trips by each mode.**

b. **Number of observed trips by each mode.**

### 4.4.4 The Abdelwahab et al. Model[21]

This model, like the Wilson et al. model, was developed using the 1984 CTS data. Twelve models in all were developed — one model for each of recreational travel, business travel, short-distance travel (less than 960 kilometres) and long-distance travel, each estimated for eastern Canada (Thunder Bay and east), western Canada (west of Thunder Bay) and Canada as a whole (representing the combination of the first two models). A common set of variables was estimated in each of the 12 models, with the exception that the recreation and business purpose models had a dummy variable capturing the short/long-distance categorization, while the short- and long-distance models similarly had a dummy variable capturing the recreation/business purpose categorization. Table 4-6 defines the variables used in the final model specification adopted, while Table 4-7 presents the model estimation results obtained for the 12 models tested.

The primary purpose of developing these models was to test the spatial transferability of intercity, multinomial, logit mode choice models. Visual comparison of the various western and eastern models indicates that the parameter estimates for corresponding models between the two regions vary. More formal statistical tests show that, even after updating model parameters before applying them to another region,[22] eastern region models are not generally transferable to western region models, and vice versa.[23] These results are generally consistent with results found in the intra-urban case, in which transferability is rarely accomplished, except in the case of very similar cities possessing very similar transportation systems, etc.[24]

*Table 4-6*

DEFINITION OF EXPLANATORY VARIABLES, ABDELWAHAB ET AL. MODEL

| Explanatory variable | Description |
|---|---|
| BUS-DUMMY | Dummy variable which is equal to 1 if bus is chosen and 0 otherwise |
| RAIL-DUMMY | Dummy variable which is equal to 1 if rail is chosen and 0 otherwise |
| AIR-DUMMY | Dummy variable which is equal to 1 if air is chosen and 0 otherwise |
| TD | Travel time (including terminal, wait and transfer times) in minutes divided by trip length in miles |
| CD | Travel cost (including overnight cost) in cents divided by trip length in miles |
| DISINC | Disposable income = household income ($000) divided by number of people contributing to household income |
| DD | Trip length dummy variable which is equal to 1 if the trip is short and chosen mode is bus or rail *or* the trip is long and chosen mode is car or air, and 0 otherwise |
| PD | Trip purpose dummy variable which is equal to 1 if the trip is recreational and chosen mode is car *or* the trip is business and chosen mode is bus, rail or air, and 0 otherwise |
| PASSNITE | Number of nights spent away from home divided by number of people on the trip |
| PCON | Number of working household members |

*Table 4-7*

ESTIMATION RESULTS, ABDELWAHAB ET AL. MODEL

| (a) Nationwide models | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Explanatory variable** | **Recreational travel** | | **Business travel** | | **Short travel** | | **Long travel** | |
| BUS-DUMMY | 2.46 | (2.17) | -0.68 | (-0.35) | 2.92 | (2.21) | 0.56 | (0.00) |
| RAIL-DUMMY | -6.12 | (-5.77) | —[a] | — | -6.41 | (-6.18) | —[a] | — |
| AIR-DUMMY | -7.23 | (-6.42) | -3.35 | (-1.73) | -7.36 | (-6.49) | -3.86 | (-2.31) |
| TD | -2.94 | (-7.72) | -3.08 | (-4.55) | -3.57 | (-7.66) | -3.50 | (-5.12) |
| CD | -0.15 | (-7.90) | -0.037 | (-1.60) | -0.15 | (-7.37) | 0.01 | (0.20) |
| DISINC | 0.07 | (3.79) | 0.053 | (1.40) | 0.092 | (5.04) | 0.0009 | (0.00) |
| DD | -2.03 | (-3.17) | -2.46 | (-3.39) | | | | |
| PD | | | | | 5.36 | (3.16) | 7.39 | (3.00) |
| PASSNITE | 0.31 | (1.30) | 0.46 | (0.79) | -0.55 | (-2.06) | 1.62 | (1.03) |
| PCON | 0.41 | (1.84) | 0.20 | (0.33) | 0.40 | (1.57) | -0.15 | (-0.30) |
| $L(\hat{\beta})$ | -326.46 | | -48.56 | | -318.68 | | -46.16 | |
| $\chi^2$ | 1,614.56 | | 340.48 | | 879.22 | | 858.28 | |
| $\rho^2$ | 0.7172 | | 0.7780 | | 0.5797 | | 0.9029 | |
| No. obs. | 1,465 | | 247 | | 1,150 | | 572 | |

*Table 4-7* (cont'd)

*ESTIMATION RESULTS, ABDELWAHAB ET AL. MODEL*

| Explanatory variable | Recreational travel | | Business travel | | Short travel | | Long travel | |
|---|---|---|---|---|---|---|---|---|
| **(b) Eastern region models** | | | | | | | | |
| BUS-DUMMY | 2.08 | (1.26) | -1.37 | (-0.33) | 3.20 | (1.77) | -1.65 | (-0.05) |
| RAIL-DUMMY | -6.53 | (-3.89) | —[a] | — | -6.06 | (-3.44) | —[a] | — |
| AIR-DUMMY | -9.41 | (-5.06) | -6.27 | (-1.91) | -8.71 | (-4.36) | -6.41 | (-1.94) |
| TD | -5.14 | (-6.30) | -5.32 | (-3.75) | -6.33 | (-7.04) | -1.87 | (-1.73) |
| CD | -0.11 | (-3.85) | -0.02 | (-0.46) | -0.09 | (-3.00) | -0.14 | (-1.00) |
| DISINC | 0.11 | (3.19) | 0.08 | (1.14) | 0.10 | (3.04) | 0.12 | (1.26) |
| DD | -1.97 | (-2.84) | -2.91 | (-1.93) | | | | |
| PD | | | | | 4.29 | (2.62) | 5.75 | (2.00) |
| PASSNITE | -0.24 | (-0.48) | 0.20 | (0.22) | -0.36 | (-0.73) | 2.29 | (0.68) |
| PCON | 0.14 | (0.32) | 0.86 | (0.79) | -0.089 | (-0.20) | 0.55 | (0.68) |
| $L(\hat{\beta})$ | -101.64 | | -10.48 | | -116.02 | | -9.00 | |
| $\chi^2$ | 516.62 | | 191.10 | | 541.582 | | 154.78 | |
| $\rho^2$ | 0.7176 | | 0.0012 | | 0.7000 | | 0.8958 | |
| No. obs. | 594 | | 110 | | 615 | | 94 | |
| **(c) Western region models** | | | | | | | | |
| BUS-DUMMY | 5.58 | (2.57) | -2.20 | (-0.63) | 5.71 | (2.54) | -0.17 | (0.10) |
| RAIL-DUMMY | -8.89 | (-5.01) | —[a] | — | -9.91 | (-4.73) | —[a] | — |
| AIR-DUMMY | -9.44 | (-5.13) | -3.11 | (-0.89) | -10.20 | (-4.83) | -6.10 | (-2.10) |
| TD | -4.14 | (-6.11) | -0.98 | (-1.99) | -4.90 | (-4.96) | -3.66 | (-2.71) |
| CD | -0.23 | (-7.19) | -0.096 | (-3.11) | -0.26 | (-6.19) | -0.015 | (-0.17) |
| DISINC | 0.081 | (2.14) | 0.11 | (1.63) | 0.16 | (3.76) | 0.056 | (0.81) |
| DD | -2.71 | (-3.09) | -1.89 | (-2.65) | | | | |
| PD | | | | | 5.27 | (3.14) | 2.09 | (1.91) |
| PASSNITE | -0.545 | (-1.50) | -0.057 | (-0.10) | -0.65 | (-1.78) | 0.85 | (0.30) |
| PCON | 0.82 | (1.99) | 0.71 | (0.69) | 0.51 | (1.17) | 0.54 | (0.52) |
| $L(\hat{\beta})$ | -103.22 | | -16.86 | | -80.68 | | -12.60 | |
| $\chi^2$ | 760.18 | | 115.20 | | 529.40 | | 390.40 | |
| $\rho^2$ | 0.7864 | | 0.7736 | | 0.786[illegible] | | 0.9394 | |
| No. obs. | 701 | | 92 | | 527 | | 270 | |

**a. Sample size limitations — rail mode not included in this model.**

**Note: Numbers in parentheses are t-statistics values.**

### 4.4.5 The Peat Marwick (PM) Model[25]

This model was developed by KPMG Peat Marwick for the Ontario/Quebec Rapid Train Task Force using 1988 survey data collected by VIA Rail for its 1989 review. It used the same data base as the HORIZONS model discussed in subsection 4.5 below. The model developed is a four-mode (air, rail, bus, car) multinomial logit model, disaggregated by business and non-business trip purposes.

Table 4-8 presents the model parameter estimates for the two models developed. As with the previous two models, one of the key features of the PM model is its treatment of income, which varies yet again from the two previous approaches. In this model, travellers were split into two groups on the basis of their income ("low," less than $30,000; "high," $30,000 or more), where income is expressed in 1988 Canadian dollars. Separate access/egress time and run-time parameters were then estimated for each income group for each trip purpose. This assumed that all other parameters in the utility functions (notably the cost parameter) were, on average, the same for the two income groups. Points to note concerning this approach to incorporating income effects within the model include the following:

- Value of time varies in this model with trip-maker income. Table 4-9(a) summarizes the values of time implied by this model by income level, trip purpose and time component.
- As with the Wilson et al. model, fare elasticities only vary with income (holding all other factors constant) to the extent that the modal probabilities change. This only occurs when income changes from below $30,000 per year to above. Otherwise, fare elasticities do not change with income.

*Table 4-8*

*ESTIMATION RESULTS, PM MODEL*

| **Variable** | **Parameter value** | |
|---|---|---|
| | **Business** | **Non-business** |
| Rail constant | -1.6600 | -1.6150 |
| Air constant | -0.2206 | -1.4846 |
| Bus constant | -4.8370 | -1.6700 |
| Cost | -0.0317 | -0.0416 |
| Access time — low income | -0.0256 | -0.0152 |
| Access time — high income | -0.0393 | -0.0255 |
| Run time — low income | -0.0037 | -0.0022 |
| Run time — high income | -0.0134 | -0.0088 |
| Frequency | 0.0992 | 0.0635 |
| Large city — rail | 1.0440 | 1.2230 |
| Large city — air | 0.4999 | 0.6338 |
| Large city — bus | 1.1360 | 1.1910 |
| Group | — | -1.3330 |

Tables 4-9(b) and 4-9(c) provide point elasticities calculated from the PM model for the Toronto–Montreal route, based on data provided in Peat Marwick (1990). Points to note from Table 4-9 include the following:

- As with all simple logit models, the cross-elasticities shown are constant across competing modes. The numbers shown represent this constant cross-elasticity for a change in fare or run time for the mode shown. For example, the PM model implies a cross-elasticity for a change in rail fare for low-income business trips of 0.44. As is discussed at length throughout this review, the constant cross-elasticity assumption of the logit model renders these cross-elasticities somewhat suspect.
- All modes are cost-elastic in this model except the car mode for non-business purposes.
- This model indicates that low-income travellers are time-inelastic across all modes. High-income travellers are time-elastic for the rail and bus modes (regardless of trip purpose) and for the car mode for business trips.
- Air-based business trips have fare cross-elasticities considerably greater than 1.0, a result which appears somewhat counter-intuitive.
- Car-based fare cross-elasticities tend to be near 1.0 in magnitude. Non-business, high-income car-based time cross-elasticities also tend to be greater than 1.0 in magnitude. If these cross-elasticities can be trusted, they imply that common carrier usage on the Toronto–Montreal route is sensitive to both car time and cost.
- With the exception of the above-mentioned two cases, the cross-elasticities shown are quite small in magnitude.

Two factors not found in the Wilson et al. model that are designed to explain the car/common carrier competition over and above travel time, cost and frequency effects are the large city and group dummy variables.[26] While the parameters for these variables have expected signs, the statistical and, more importantly, numerical significance of these terms implies that further categorization of the market may well be required to properly specify the decision processes at work in the Windsor–Quebec City corridor.

*Table 4-9*

## VALUES OF TIME AND ELASTICITIES, PM MODEL

**(a) Values of time ($/hour)**

| Trip purpose | Income level | Access/egress | Line-haul |
|---|---|---|---|
| Business | High | 75 | 25 |
| | Low | 48 | 7 |
| Non-business | High | 37 | 13 |
| | Low | 22 | 3 |

**(b) Fare elasticities, Toronto–Montreal[a]**

| | Direct elasticities | | | | Cross-elasticities | | | |
|---|---|---|---|---|---|---|---|---|
| | Rail | Air | Bus | Car | Rail | Air | Bus | Car |
| **Business** | | | | | | | | |
| Low income | −1.76 | −3.51 | −1.04 | −2.08 | 0.44 | 2.61 | 0.02 | 1.14 |
| High income | −2.06 | −1.57 | −1.06 | −2.60 | 0.14 | 4.55 | 0.00 | 0.62 |
| **Non-business, non-group** | | | | | | | | |
| Low income | −1.49 | −4.31 | −1.11 | −0.52 | 0.27 | 0.30 | 0.24 | 0.81 |
| High income | −1.56 | −3.95 | −1.25 | −0.44 | 0.19 | 0.66 | 0.10 | 0.90 |
| **Non-business, group** | | | | | | | | |
| Low income | −1.66 | −4.50 | −1.26 | −0.19 | 0.10 | 0.11 | 0.09 | 1.14 |
| High income | −1.69 | −4.38 | −1.31 | −0.15 | 0.07 | 0.23 | 0.03 | 1.18 |

**(c) Run time elasticities, Toronto–Montreal[a]**

| | Direct elasticities | | | | Cross-elasticities | | | |
|---|---|---|---|---|---|---|---|---|
| | Rail | Air | Bus | Car | Rail | Air | Bus | Car |
| **Business** | | | | | | | | |
| Low income | −0.90 | −0.15 | −1.34 | −0.80 | 0.22 | 0.11 | 0.03 | 0.44 |
| High income | −3.82 | −0.24 | −4.94 | −3.63 | 0.25 | 0.69 | 0.01 | 0.86 |
| **Non-business, non-group** | | | | | | | | |
| Low income | −0.57 | −0.14 | −0.67 | −0.29 | 0.10 | 0.01 | 0.14 | 0.45 |
| High income | −2.38 | −0.52 | −3.02 | −0.96 | 0.30 | 0.09 | 0.24 | 1.99 |
| **Non-business, group** | | | | | | | | |
| Low income | −0.63 | −0.15 | −0.76 | −0.11 | 0.04 | 0.00 | 0.05 | 0.63 |
| High income | −2.57 | −0.58 | −3.17 | −0.33 | 0.10 | 0.03 | 0.08 | 2.61 |

[a] **Calculated using data provided in Exhibit II-11 (Peat Marwick 1990).**

In particular, note that the net bias of non-business group travellers to non-large cities is virtually –3.0 for both the rail and bus modes (–2.948 for rail, –3.003 for bus; obtained by adding the modal constant to the group variable parameter). This means that for either of these modes to be preferred to the car mode they would have to be $72 *cheaper* than the car mode or *save* 341 minutes in run time relative to the car (assuming the high-income case; multiply by 4.0 for the low-income case) or some combination of these two cases. Similar comparisons can be constructed for access time and frequency effects. Since rail and bus costs and frequencies are worse than car costs and frequencies (especially for a group), and rail and bus times are comparable, one can expect rail and bus choice probabilities for this group to be approximately $e^{-3.0}$ or 0.05 times the car choice probability value. Although more difficult to evaluate in the abstract, the air mode is likely to be similarly uncompetitive for this category of travellers, given that the very high cost of the mode (especially on a group basis) is likely to more than compensate for its smaller run times and slightly smaller modal constant. (Also note that air access times are likely to be larger than rail and bus access times for this category of traveller as well.)

Given this result it may well be the case that the non-business travel market should be further divided into group trip-makers and individual trip-makers. At a minimum, these two categories of travellers likely have quite different utility functions in terms of relevant variables and their parameter values. Even more fundamentally, they may also have very different *choice sets* from which they are making their choices. In particular, group non-business travellers between smaller cities may be effectively "captive" to the car mode (at least those with access to a car), regardless of whether or not common carrier modes are objectively available to them. If this is the case, then group travellers should be separately analyzed from other types of travellers, and their inclusion in the overall non-business market simply obscures and confounds the relationships which exist within this market.

Similar points can be made with respect to the large-city dummy variables, which significantly reduce the magnitudes of the net bias for each mode. (In the case of the air mode for business travel, the large-city variable actually changes the sign of the air bias term from negative (relative to car) to positive.) This might again point to the existence of two travel markets: a large-city market, in which the four modes compete on a more even basis, largely as a function of their relative modal service characteristics, and a small-city model, in which people are predisposed to the use of the car for reasons that go beyond the measured time, cost and frequency values of the competing modes. Alternatively or in combination with this, it might imply some problem in the definition of modal service variables and/or modal availability (that is, choice sets) for small cities within the model's data base.

This discussion of the implications of large dummy variable and modal bias parameter values raises the more general question of the role of modal bias (or alternative-specific constant) terms in models such as the multinomial logit model. They are intended to capture the "all else being equal," *systematic* preferences shown by travellers for the various modes; that is, they capture systematic effects of modal or personal characteristics that affect mode choice but which are not otherwise explicitly captured within the model (typically these factors might include comfort and convenience effects, safety, reliability, etc.). Such bias terms *must* be included in "ranked alternatives" models such as logit mode choice models to avoid creating a bias in other parameters in the model.[27] Ideally, one hopes these terms prove to be numerically small in value, even if they are statistically significant. In practice, however, they are often numerically large, relative to other terms in the modal utility functions.

The PM model is typical in this respect, with all but the air business constant being both statistically significant and numerically large. Referring back to Tables 4-2 and 4-3, it is clear that both the Ridout–Miller model and the Wilson et al. model can be similarly criticized. For example, the rail business constant implies that the rail mode would have to be $52 cheaper than the car mode to nullify the impact of this constant on business travellers' utility calculations. The presence of these large constants raises several important concerns about the use of such models in forecasting. These include the following:

- To the extent that such terms dominate the utility functions, changes in level-of-service associated with alternatives under consideration result in small predicted changes in mode choice.
- The presence of such large constant terms generally implies that important variables affecting mode choice have been omitted from the systematic utility function.

- As noted above, such large bias terms may, in fact, be indicative of a mis-specification of the market in terms of the choice sets actually or perceived to be available to travellers. The bus business constant of −4.84 implies that the model would significantly overpredict bus usage by business travellers on the basis of cost, time and frequency alone. Over and above the omitted variables effect, it may well be that most business travellers simply do not consider the bus as a viable mode for most business trips. If this is the case, then inclusion of the bus mode in the choice sets for these travellers represents a mis-specification of the problem.
- The impact of introducing a new or dramatically upgraded mode such as high-speed rail is very difficult to forecast when large bias terms are present, since it is not at all clear what the new mode's bias term should be. In particular, a persuasive argument can be made that the rail bias terms of −1.660 and −1.615 in the PM business and non-business models should *not* be retained if the current corridor service is replaced with a significantly upgraded (or, one might well argue, entirely new) high-speed rail service. It is also unclear, based on the historically observed behaviour in the system, what the new mode's bias term value should be.[28]

This last point obviously lies at the heart of much of the debate concerning intercity travel demand model specification and application, especially when such models are frequently motivated by the need to study the impact of new modes on corridor flows and mode splits.[29] The elimination of this problem is the primary motivation of the abstract mode modelling approach characteristic of early aggregate modelling efforts. It is clear, however, that our intercity models, theories and data bases are such that abstract mode models (either aggregate or disaggregate) are not likely to be achieved in practice, leaving modellers to deal with the existence of the modal constants the best way possible. Approaches include:

- Leaving the constants "as is." This is appropriate for minor system changes or, perhaps, for short-run impacts of major system changes. It is likely, however, to be overly conservative with respect to the long-run impact of major service improvements.
- Judgementally changing the constants, perhaps based on experience with similar changes observed in other similar corridors. This approach can provide useful sensitivity testing of the model's forecasts. It also opens the technical demand-forecasting process up to charges from critics of

"tinkering" with the model to generate more desirable results. Further, similar changes in similar corridors are much more difficult to find in practice than many planners would like to admit.

- Developing an alternative model or modelling approach which permits a more sensitive treatment of the changes being considered while at the same time being "objectively defensible." Examples of such approaches are presented in subsection 4.5 below.

### 4.4.6 The Koppelman Model[30]

Koppelman has used 1977 Nationwide Personal Transportation Study (NPTS) data to develop four-stage nested logit models of U.S. intercity business and non-business passenger travel. The four stages are: trip frequency choice, trip destination choice, mode choice and service class choice. Each model stage is conditional upon higher-level decisions (for example, service class choice is conditional upon the mode chosen) and affects these higher-level decisions through the use of "inclusive value" terms in the upper-level utility functions to represent the expected utility associated with the lower-level decision. For example, consider the lowest two levels of the Koppelman model: mode and service class choice. In the nested logit model formulation, service class choice, conditional upon mode choice, is represented as an ordinary logit model of the form:

$$P_{c|m} = e^{V_{c|m}/\phi} / \sum_{c'} e^{V_{c'|m}/\phi} \qquad [4.10]$$

where $P_{c|m}$ is the probability of choosing service class $c$ given mode choice $m$, $V_{c|m}$ is the systematic utility of service class $c$ for mode $m$, and $\varphi$ is a scale parameter which must lie between zero and one for a properly specified model. The upper level mode choice model is then given by:

$$P_m = e^{(V_m + \phi I_m)} / \sum_{m'} e^{(V_{m'} + \phi I_{m'})} \qquad [4.11]$$

where $V_m$ is the systematic utility of mode $m$ (excluding factors relating to service class choice) and $I_m$ is the inclusive value associated with the lower-level service class choice for mode $m$. This inclusive value is the expected maximum utility associated with the service class choice given that mode is selected. For logit models, this expected maximum utility can be shown to be:[31]

$$I_m = \log_e(\Sigma_c e^{V_{c|m}/\theta}) \qquad [4.12]$$

This four-stage nested approach is intended to provide a theoretically consistent and sound approach to modelling intercity travel demand.[32] Specific advantages of the approach include the following:

- It permits multistage models to be built which are internally consistent (that is, with respect to scale, modelling assumptions, etc.).
- It provides an explicit, theoretically sound expression for the "trip induction" term to be included in the trip generation/distribution stage(s) of the model; that is, the inclusive value term constructed using the mode-choice model utilities for inclusion in the higher-level trip distribution model. For example, if this model is expressed as the probability of choosing destination *d* given a known origin zone *o*, then the corresponding inclusive value ("trip induction") term is given by.

  $$I_{d|o} = \log_e[\Sigma_m e^{(V_m+\theta I_m)/\delta}] \qquad [4.13]$$

  where δ is the scale parameter for the mode choice level in the nested structure (that is, it will lie between zero and one in value and will be the parameter multiplied by $I_{d|o}$ in the destination choice model). Use of $I_{d|o}$ in the destination choice model to represent the impact of service changes on trip generation/distribution will result in theoretically consistent direct and cross-elasticities and should result in plausible levels of trip induction occurring (something that most ad hoc trip induction terms traditionally used do not often achieve).
- The nested approach at least partially circumvents the IIA or constant cross-elasticity assumption discussed in subsection 4.2. From the point of view of the overall joint choice process, correlation is permitted among alternatives sharing common upper-level components. For example, at the mode choice level, air mode service class combinations possess correlation because they share the air mode component of the "choice bundle." These air-related alternatives, however, are still assumed to be uncorrelated with the other alternatives at this level — the rail, bus and car modes. Similarly, at the destination choice level, the mode-destination "bundles" are correlated for a given destination because they share this common destination choice, but alternative destinations (and mode choices across these alternative destinations) remain uncorrelated. Thus, the nested logit model permits a significant relaxation of the very strict IIA assumption

of the ordinary logit model, although it still incorporates a fairly rigid covariance structure among the alternatives which may or may not be acceptable within a given application. This point is discussed further in subsection 4.5.

The disaggregate approach is motivated by the concerns raised in Section 2 of this report concerning aggregation bias. Unfortunately, a truly disaggregate data set of intercity passenger demand was not available for this model's development. The NPTS data set was used because it was the most disaggregate available, but it lacked sufficient spatial detail to allow access and egress times and costs to be computed. Thus, the primary purpose of this model is to demonstrate the feasibility of the disaggregate, nested logit modelling approach rather than develop a definitive model for policy testing.[33]

Given the emphasis within this paper on mode-split modelling, only the service class and mode choice models of the Koppelman model are discussed. Table 4-10 presents the air mode service-class model developed. This is a three-alternative model (first class, coach and discount class). Data limitations prevented the development of a comparable rail service-class model. Similarly, the data base was not large enough to support the development of separate air service-class models for business and non-business trips. Trip purpose, therefore, was incorporated into the model using dummy variables. The results indicate that business travellers are much less likely to use the discount class (presumably due to the various booking and scheduling constraints associated with this fare class), but show little preference between the coach and first-class alternatives, as indicated by the numerically small and statistically insignificant parameter for the business trip first-class dummy variable.

Cost, total daily departures (which typically vary by fare class) and income all enter the model in statistically significant ways with expected signs. In particular, higher-income people are less likely to choose discount class and more likely to take first class, relative to coach. Travel time is not included in this stage of the model since it is invariant across service classes for a given origin-destination pair.

### *Table 4-10*

### FARE/SERVICE CLASS CHOICE, KOPPELMAN MODEL

| **Variable** | **Estimate** | **$t$-statistics value** |
|---|---|---|
| Alternative-specific constant | | |
| Discount class | -0.311 | 0.6 |
| First class | -0.889 | 1.2 |
| Level of service | | |
| Fare cost ($) | -0.010 | 2.7 |
| Daily departures | 0.555 | 4.1 |
| Income ($10,000) | | |
| Discount class | -0.263 | 1.3 |
| First class | 0.350 | 2.1 |
| Business trip | | |
| Discount class | -1.605 | 3.7 |
| First class | -0.160 | 0.3 |

| **Goodness-of-fit measures** | |
|---|---|
| Log likelihood | |
| At equal shares | -258.2 |
| At market shares | -205.3 |
| At $\hat{\beta}$ | -172.3 |
| Likelihood ratio index ($\rho^2$) | |
| Equal share base | 0.333 |
| Market share base | 0.161 |
| Number of cases | 235 |

Table 4-11 presents the business mode choice model developed. This is a very simple model relative to the other models reviewed in this section. Points to note from this table include the following:

- The time-cost structure of the specification is the same as the Wilson et al. structure (that is, generic cost term, travel times categorized by income level), and hence the same comments concerning time and cost elasticities apply.
- Values of time cannot be deduced from this model since they were assumed prior to model estimation to be $60/hour and $20/hour for high- and low-income travellers, respectively, and then used to construct a "generalized cost" term to use in the model estimation. This approach was adopted to circumvent the high collinearity between travel time and cost that was found in the data — a common problem in intercity travel demand modelling.

*Table 4-11*

**BUSINESS TRIP MODE CHOICE, KOPPELMAN MODEL**

| Variable | Estimate | t-statistics value |
|---|---|---|
| Alternative constant | | |
| Car | -0.883 | 1.5 |
| Bus | -1.703 | 2.2 |
| Rail | -2.227 | 2.8 |
| Level of service | | |
| Cost ($) | -0.0046 | 3.0[a] |
| Travel time — high income[a] (minutes) | -0.276 | 3.0[a] |
| Travel time — low income[a] (minutes) | -0.092 | 3.0[a] |
| Distance less than 250 miles[a] | 0.324 | 1.5 |
| Car | 2.263 | 4.3 |
| Bus and rail | 1.994 | 2.9 |

| Goodness-of-fit measures | |
|---|---|
| Log likelihood | |
| At equal shares | -359.1 |
| At market shares | -193.7 |
| At $\hat{\beta}$ | -136.3 |
| Likelihood ratio index ($\rho^2$) | |
| Equal share base | 0.623 |
| Market share base | 0.304 |
| Number of cases | 259 |

a. **Travel time and cost variables were estimated as part of generalized cost with value of time set at $60/hour for high-income and $20/hour for low-income travellers.**

- The inclusive value parameter lies between zero and one in value. This implies that the nested model structure assumed cannot be rejected.
- As in the Ridout-Miller model, bus and rail frequencies were found to be statistically insignificant for business trip mode choice. Air frequency, as represented within the inclusive value term, does have a significant, albeit indirect, impact on business mode choice.
- All three surface modes are more attractive than the air mode for short trip distances, as indicated by their numerically large and statistically significant parameters on the dummy variables for trips of less than 250 miles in length.

Table 4-12 presents Koppelman's non-business mode choice model. Points to note from this table include the following:

- Values of time were fixed within the model prior to estimation to permit a generalized cost to be computed. In this case, $45/hour and $15/hour were assumed for high- and low-income travellers, respectively.
- As in the Ridout–Miller model, frequency is correctly signed and significant for non-business trips.

*Table 4-12*

*NON-BUSINESS TRIP MODE CHOICE, KOPPELMAN MODEL*

| **Variable** | **Estimate** | ***t*-statistics value** |
|---|---|---|
| Alternative constant | | |
| Car | 1.687 | 4.0 |
| Bus | 0.386 | 0.6 |
| Rail | 0.137 | 0.2 |
| Level of service | | |
| Cost ($) | -0.00257 | 3.8[a] |
| Travel time — high income (minutes) | -0.1154 | 3.8[a] |
| Travel time — low income (minutes) | -0.0385 | 3.8[a] |
| Bus and rail frequency | 0.0399 | 1.9 |
| Composite air class utility | 0.456 | 4.0 |
| Income ($10,000) | | |
| Car | 0.0746 | 0.6 |
| Bus and rail | -0.4539 | 2.4 |
| Distance less than 250 miles | | |
| Car | 1.703 | 3.8 |
| Bus and rail | 0.8565 | 1.5 |
| Distance less than 500 miles | | |
| Car | 1.796 | 3.5 |
| Bus and rail | -0.816 | 1.3 |
| **Goodness-of-fit measures** | | |
| Log likelihood | | |
| At equal shares | -495.6 | |
| At market shares | -347.3 | |
| At $\hat{\beta}$ | -265.0 | |
| Likelihood ratio index ($\rho^2$) | | |
| Equal share base | 0.465 | |
| Market share base | 0.235 | |
| Number of cases | 356 | |

**a. Travel time and cost variables were estimated as part of generalized cost with value of time set at $45/hour for high-income and $15/hour for low-income travellers.**

- In addition to the categorization of the travel time term by income, income enters this model directly. The results indicate that increasing income results in lower bus and rail utilities and has a small and statistically weak positive impact on car utilities, relative to the air mode.
- Distance effects are again captured by dummy variables. As in the business model, short (less than 250 miles) trips exhibit a surface mode bias relative to the air mode. This bias reverses in the case of the rail and bus modes for long-distance trips (greater than 500 miles), but remains strongly positive for the car mode.

## 4.5 STATED PREFERENCE MODELS

Considerable research has been undertaken to develop and assess stated preference based models for travel demand modelling applications. Early work in this area includes Louviere et al. (1981) and Louviere and Hensher (1982). For more recent reviews see Hensher et al. (1988) and Ben-Akiva et al. (1990). In general, the main advantages of the stated preference approach include the following:

- It provides the analyst with far greater control over the range and combination of service factors to which respondents are exposed, allowing for the investigation of a greater variability in travel times, fares, etc., than is often possible in revealed preference contexts (in which only the times, fares, etc., experienced on the relatively few number of origin-destination pairs sampled can be used). It also means that the high correlation between time and cost which often exists in observed systems can be "broken" by using uncorrelated combinations of these variables.
- It allows hypothetical or not-yet-existing modes or service levels to be tested for trip-maker responses. This is especially valuable for high-speed rail applications in which revealed preference data may "misrepresent" the modal biases expected for such services.

The major disadvantages of the approach are, first, that it requires very careful survey designs in order to ensure that valid responses are obtained. Second, questions still exist among some travel demand modellers concerning the overall validity of the technique; that is, can stated preference data be trusted to provide useful estimates of what people will actually do when faced with real, rather than hypothetical, choices? Full investigation of this issue is well beyond the scope of this paper. The operating assumption of this review is that the answer to this question is provisionally yes, especially given the relatively promising field results discussed below.[34]

Several stated preference based models relating to intercity travel demand have been developed. Louviere and Hensher (1982), for example, investigated both intercity air–bus competition in the U.S. midwest and destination/fare class choice for leisure air travel from Australian origin cities. Morikawa et al. (1991) discussed combining revealed preference and stated preference data in a model of Japanese intercity mode choice among rail, bus and car modes. This latter study is of particular interest because it may represent a practical method for using the strengths of both revealed preference and stated preference data while minimizing the weaknesses of both approaches. More research is required before the overall utility of this approach can be assessed.

The remainder of this section focusses on two major, operational applications of the stated preference approach to intercity passenger travel demand modelling. The first is the COMPASS model, the successor to the SIGNALS and HORIZONS models developed for and used by VIA Rail in its 1984 and 1989 high-speed reviews, respectively. COMPASS has also been used in several U.S. high-speed rail studies. The second is a model developed by Charles River Associates (CRA), which has also seen application in several U.S. high-speed rail corridor studies. These two modelling approaches are reviewed in subsections 4.5.1 and 4.5.2.

### 4.5.1 SIGNALS, HORIZONS, COMPASS: Evolution of a Stated Preferences Approach and Overall Modelling System

SIGNALS, HORIZONS and COMPASS represent three generations of essentially the same model design. The first-generation model is SIGNALS, the property of Transmark (the consulting wing of British Rail), which was used, along with PERAM, by VIA Rail in its 1984 high-speed rail study. SIGNALS is the least well documented of the three models[35] and has been largely superseded for Canadian modelling applications by the other two models. Hence, the remainder of this section will focus on HORIZONS and COMPASS.

HORIZONS is the second-generation model, developed by Cole, Sherman and Associates Ltd. for use in VIA's 1989 review. COMPASS is the third and most recent version of this modelling system. It is the property of

Transportation and Economic Management Systems, Inc. (TEMS) and has been applied in several recent U.S. high-speed rail corridor studies. The common thread through this evolutionary process is that all three models have the same primary designer (Dr. Alex Metcalfe), and each succeeding model has built on the experience gained in the previous model, both in terms of the evolution of improved methods and in terms of incorporating data and empirical relationships from previous models into the succeeding versions.

*COMPASS:*[36] COMPASS is a multimode (air, rail, bus, car) modelling system which contains four major components dealing with total travel demand by all modes (as a function of socio-economic factors); induced demand (generated by changes in modal service levels); modal split; and "economic rent" (dealing with the impact of modal service changes on property values, income, employment, etc., in areas served by the intercity transportation system). It is a PC-based software system written in C, which has been designed to provide a modelling platform within which a range of models and modelling assumptions can be tested against a common data base relating to socio-economic and transport network characteristics.

The mode-split model used within this overall modelling stystem is a hierarchical decision structure in which total demand is first split between car and common carrier modes. The common carrier demand is then split between air and surface modes. The surface mode demand is then split between rail and bus. At each stage a binary logit model is estimated that has the form:

$$P_{ijp1} = 1/(1 + \exp\{-[B_{0p} + B_{1p} f(\mathrm{GC}_{ijp1}, \mathrm{GC}_{ijp2})]\}) \qquad [4.14]$$

where:

$P_{ijp1}$ = probability of choosing alternative "1" from the set of alternatives {1, 2} (where, for example, alternative 1 might be auto and alternative 2 would then be common carrier) for origin-destination pair *ij* for trip purpose *p*

$\mathrm{GC}_{ijpm}$ = "generalized cost" of travel by mode *m* for purpose *p* for origin-destination pair *ij*

$f(\ )$ = either the difference of the generalized costs for the two alternatives (alternative 1 minus alternative 2) or the ratio of the generalized costs (alternative 1 divided by alternative 2)

$B_{0p}, B_{1p}$ = model parameters for trip purpose $p$

The model parameters are estimated through regression analysis of the linearized form of equation [4.14]:

$$\log_e (P_{ijp1}/P_{ijp2}) = B_{0p} + B_{1p} f(GC_{ijp1}, GC_{ijp2}) \qquad [4.15]$$

The generalized cost terms for composite alternatives (for example, for surface common carrier modes) are constructed by weighting the generalized costs of the individual alternatives constituting the composite.

The modal generalized cost is defined as:

$$\mathrm{GC}_{ijpm} = \mathrm{TT}_{ijm} + \mathrm{TC}_{ijpm}/\mathrm{VOT}_{pm} + (\mathrm{VOF}_{mp}{*}\mathrm{OH})/(\mathrm{VOT}_{pm}{*}F_{ijm}) \qquad [4.16]$$

where:

$\mathrm{TT}_{ijm}$ = total travel time from $i$ to $j$ by mode $m$, with "out-of-vehicle" time components (access/egress, waiting, etc.) weighted by a factor of 2 to represent the additional disutility associated with these aspects of the trip

$\mathrm{TC}_{ijm}$ = total travel cost for the trip (including access/egress costs) for mode $m$ from $i$ to $j$

$\mathrm{F}_{ijm}$ = frequency from $i$ to $j$ for mode $m$ (departures per week)

OH = operating hours per week

$\mathrm{VOT}_{pm}$ = value of time for mode $m$ for purpose $p$

$\mathrm{VOF}_{pm}$ = value of frequency for mode $m$ for purpose $p$

Values of time and frequency are derived through data gathered from an attitudinal survey of intercity travellers, segmented by trip purpose, mode, distance (short/long) and income (high/low), designed to elicit the respondents' stated preferences with respect to mode choice as a function of modal attributes. Two methods are used to compute VOT and VOF from these data. The first method (Method 1) is called the "comparison method," in which the VOT (VOF) at which an individual switches from preferring the higher cost, lower travel time (higher frequency) alternative to preferring the lower cost alternative is used to define the VOT (VOF). The second method (Method 2) involves estimating binary logit models, with VOT and VOF values derived from the logit model coefficients.

Table 4-13 presents results from these two methods of calculating value of time for the tri-state corridor (Chicago–Milwaukee–Twin Cities). Table 4-14 compares the tri-state VOTs with those found in other corridor studies. It is suggested by the model developers that the higher tri-state VOTs reflect the longer trip distances in this corridor. Table 4-15 provides additional VOT/VOF information from the tri-state study.

*Table 4-13*

COMPARISON OF VOT RESULTS, TRI-STATE COMPASS MODEL

| | No. of valid surveys | | VOT (1990$/hour) | |
|---|---|---|---|---|
| **Mode/purpose** | **Method 1** | **Method 2** | **Method 1** | **Method 2** |
| Air/business | 183 | 77 | 64.8 | 66.6 |
| Air/other | 270 | 97 | 34.0 | 41.9 |
| Rail/business | 63 | 24 | 39.9 | 45.1 |
| Long trips[a] | 14[b] | 8[b] | 44.5 | 39.8 |
| Short trips | 49 | 16[b] | 38.6 | 47.7 |
| Rail/other | 207 | 115 | 28.0 | 32.8 |
| Long trips | 149 | 101 | 31.0 | 37.4 |
| Short trips | 58 | 14[b] | 20.1 | 30.0 |
| Bus/other | 145 | 64 | 21.8 | 31.7 |
| Long trips | 72 | 48 | 28.5 | 34.2 |
| Short trips | 73 | 16[b] | 15.1 | 24.1 |
| Car/business | 54 | 36 | 43.0 | 44.2 |
| Long trips | 35 | 23[b] | 46.3 | 47.4 |
| Short trips | 19[b] | 13[b] | 37.1 | 38.5 |
| Car/commuting | 142 | 50 | 21.3 | 30.3 |
| Long trips | 6[b] | 3[b] | 25.7 | 47.4 |
| Short trips | 136 | 47 | 20.9 | 29.3 |
| Car/other | 377 | 200 | 25.8 | 37.4 |
| Long trips | 221 | 145 | 32.3 | 37.4 |
| Short trips | 156 | 55 | 16.9 | 37.1 |

a. **Long trips are over 100 miles, and short trips are 100 miles or less.**

b. **Less than 30 valid surveys.**

### Table 4-14

### COMPARISON OF VOT RESULTS, SELECTED CORRIDOR STUDIES[a]

| | Tri-State (430 miles) | New York[b] (310 miles) | Ontario–Quebec[c] (180–300 miles) | Illinois[d] (200–300 miles) |
|---|---|---|---|---|
| | Value of time (1990$/hour) | | | |
| Air | | | | |
| Business | 64 | 51 | 58 | 54 |
| Non-business | 34 | 32 | 32 | 19 |
| Rail | | | | |
| Business | 40 | 26 | 25 | 28 |
| Non-business | 28 | 21 | 19 | 13 |
| Car | | | | |
| Business | 43 | 26 | 25 | 23 |
| Non-business | 26 | 26 | 18 | 13 |
| Bus | | | | |
| Business | 25 | — | 17 | — |
| Non-business | 22 | 32 | 12 | — |
| | Value of frequency (1990$/hour) | | | |
| Air | | | | |
| Business | 33 | 24 | 31 | 11 |
| Non-business | 22 | 3 | 21 | 7 |
| Rail | | | | |
| Business | 18 | 11 | 15 | 6 |
| Non-business | 16 | 8 | 11 | 4 |
| Car | | | | |
| Business | — | 17 | 18 | 7 |
| Non-business | — | 14 | 12 | 6 |
| Bus | | | | |
| Business | 16 | — | 13 | — |
| Non-business | 13 | 10 | 9 | — |

**a.** **To facilitate comparison with the tri-state study, values derived for the other three corridors were inflated to 1990$.**

**b.** **Rensselaer Polytechnic/Cole, Sherman Inc.**

**c.** **Consumer Contact Ltd/Cole, Sherman Inc.**

**d.** **British Rail.**

Table 4-15

## DETAILED VOT AND VOF RESULTS, TRI-STATE COMPASS MODEL

**(a) Summary of VOT and VOF trade-off results**

| | Air | Rail | Bus | Car |
|---|---|---|---|---|
| | Value of time (1990$/hour) | | | |
| Business | 64.8 | 39.9 | 25.4[a] | 43.0 |
| Commuting | 50.9[a] | 27.0 | 13.7[a] | 21.3 |
| Other | 34.0 | 28.0 | 21.8 | 25.8 |
| | Value of frequency (1990$/hour) | | | |
| Business | 33.4 | 17.7 | 15.5[a] | — |
| Commuting | 27.7[a] | 16.1 | 10.9[a] | — |
| Other | 22.0 | 16.1 | 13.0 | — |

**(b) VOT and VOF trade-off results by trip length[b]**

| | | Rail | | Bus | | Car | |
|---|---|---|---|---|---|---|---|
| | Air | Long | Short | Long | Short | Long | Short |
| | Value of time (1990$/hour) | | | | | | |
| Business | 64.8 | 44.5<br>(14)[d] | 38.6 | NI[c] | NI | 46.3 | 37.1<br>(7) |
| Commuting | NI | NI | 27.0 | NI | 13.7<br>(7) | 25.7 | 20.9 |
| Other | 34.0 | 31.0 | 20.1 | 28.5 | 15.1 | 32.3 | 16.9 |
| | Value of frequency (1990$/hour) | | | | | | |
| Business | 33.4 | 18.2<br>(13) | 17.5 | NI | NI | — | — |
| Commuting | NI | NI | 16.1<br>(21) | NI | 10.0<br>(7) | — | — |
| Other | 22.0 | 17.8 | 11.7 | 15.1 | 10.9 | — | — |

*Table 4-15 (cont'd)*

**DETAILED VOT AND VOF RESULTS, TRI-STATE COMPASS MODEL**

**(c) VOT and VOF trade-off results by income group[e]**

| | Air | | Rail | | Bus | | Car | |
|---|---|---|---|---|---|---|---|---|
| | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** |
| | Value of time (1990$/hour) | | | | | | | |
| Business | 73.7 | 55.6 | 45.7<br>(27)[d] | 35.0 | NI[c] | 21.6 | 44.9<br>(22) | 41.7 |
| Commuting | NI | NI | NI | NI | 26.8<br>(28) | 20.2 | NI | NI |
| Other | 36.4 | 32.0 | 30.2 | 26.9 | 29.5 | 25.5 | 21.8<br>(21) | 22.4 |
| | Value of frequency (1990$/hour) | | | | | | | |
| Business | 35.4 | 32.6 | 19.9<br>(27) | NI | NI | NI | — | — |
| Commuting | 25.9 | 20.3 | 14.5 | 11.4<br>(20) | 11.4<br>(20) | 13.5 | — | — |

**a.** **Quota cells not originally identified for analysis.**

**b.** **"Long" indicates long-distance trips of more than 100 miles, and "short" indicates short trips of 100 miles or less.**

**c.** **"NI" stands for "not included" and indicates quote cells deliberately excluded from the quota survey and trade-off analysis as they were too small a sample group to be effectively analyzed.**

**d.** **Quota cells with numbers in parentheses had less than 30 valid surveys; the number given in parentheses is the actual number of surveys.**

**e.** **"High" stands for high household income of $60,000 or more per year, and "low" indicates low household income of less than $60,000 per year.**

Finally, Table 4-16 presents the estimation results for the three binary logit models developed for the tri-state corridor. Note that with the exception of the business air-surface model, the difference formulation consistently generates a higher $r^2$ value than the corresponding ratio formulation. This is presumably an encouraging result in that the difference formulation is consistent with the random utility theory derivation of the model,[37] whereas the ratio formulation is much more ad hoc in rationale. Also note that the bias column in each part of this table indicates the percentage of trips predicted by the model to take the indicated mode when the generalized costs of the mode and its alternative are equal. The extent to which this percentage is less than 50 percent is indicative of factors other than generalized cost which affect the given choice but which are not explicitly captured within the model except in the constant terms (for example, convenience and privacy with respect to the car).

Table 4-16

ESTIMATION RESULTS, TRI-STATE COMPASS MODEL

| Purpose | Model | $B_{0p}$ | $B_{1p}$ | $r^2$ | Bias (%) |
|---|---|---|---|---|---|
| **(a) Public versus car mode-split model coefficients (car bias)** | | | | | |
| Business | Ratio | 1.747 (12) | −1.941 (−17) | 0.58 | 5 |
| | Difference | −0.120 (−14) | −0.010 (−14) | 0.79 | 3 |
| Commuting | Ratio | 0.922 (8) | −1.203 (−12) | 0.36 | 7 |
| | Difference | −0.161 (−13) | −0.007 (−18) | 0.60 | 4 |
| Other | Ratio | −0.378 (−14) | −0.866 (−16) | 0.35 | 12 |
| | Difference | −0.279 (−17) | −0.002 (−23) | 0.63 | 7 |
| **(b) Surface versus air mode-split model coefficients (air bias)** | | | | | |
| Business | Ratio | 2.795 (20) | −3.894 (−17) | 0.67 | 25 |
| | Difference | −0.840 (−15) | −0.006 (−14) | 0.62 | 20 |
| Commuting | Ratio | 4.122 (—) | −4.241 (—) | — | 3 |
| | Difference | −0.000 (—) | −0.005 (—) | — | 0 |
| Other | Ratio | 4.122 (11) | −4.241 (−10) | 0.66 | 3 |
| | Difference | −0.000 (−16) | −0.005 (−13) | 0.70 | 0 |
| **(c) Rail versus bus mode-split model coefficients (rail bias)** | | | | | |
| Business | Ratio | 7.858 (7) | −6.019 (−3) | 0.66 | 36 |
| | Difference | 2.110 (5) | −0.009 (−7) | 0.82 | 39 |
| Commuting | Ratio | 7.739 (4) | −7.066 (−4) | 0.36 | 16 |
| | Difference | 0.631 (5) | −0.008 (−5) | 0.41 | 15 |
| Other | Ratio | 5.583 (4) | −5.137 (−6) | 0.62 | 11 |
| | Difference | 0.382 (7) | −0.007 (−4) | 0.64 | 9 |

*HORIZONS:*[38] Two versions of HORIZONS were developed during the 1989 Rail Passenger Review Study. The interim model (HORIZONS I) used the COMPASS mode-split modelling method described above; that is, sequential binary models, with weighted average generalized cost terms used at each level to represent the level of service associated with the next lower level in the decision tree. Table 4-17 presents the parameter estimates for the Windsor–Quebec City corridor obtained for this version of the model, using the 1988 data base developed as part of this study.

This use of weighted average generalized costs to represent lower-level service attributes, however, can be criticized in that it is ultimately an ad hoc formulation which is not consistent with random utility theory. Further, random utility theory provides an explicit specification of what a representative service term should consist. It is the so-called "inclusive value" or "logsum" term of the nested logit model discussed in subsection 4.4.6. The adoption of the inclusive value formulation for the representative lower level service measure necessitates the use of the difference formulation of the model, since this is the only version which is mathematically and theoretically consistent with this term's use.

Table 4-17

ESTIMATION RESULTS, INTERIM HORIZONS MODEL

**(a) Public versus car mode-split model coefficients**

| Purpose | Model | $B_0$ | $B_1$ | $r^2$ | % public |
|---|---|---|---|---|---|
| Business | Ratio | 1.0708 | -1.3478 (131) | 0.77 | 43 |
| | Diff. | 0.3130 | -0.0134 (89) | 0.60 | 57 |
| Commuting | Ratio | 0.5268 | -1.1301 (85) | 0.70 | 35 |
| | Diff. | -2.4101 | -0.0074 (18) | 0.09 | 8 |
| Tourist/others | Ratio | -0.1851 | -0.8144 (82) | 0.52 | 27 |
| | Diff. | -1.8588 | -0.0030 (17) | 0.04 | 13 |

**(b) Surface versus air mode-split model coefficients**

| Purpose | Model | $B_0$ | $B_1$ | $r^2$ | % surface |
|---|---|---|---|---|---|
| Business | Ratio | 3.7857 | -4.2083 (159) | 0.80 | 40 |
| | Diff. | -0.4648 | -0.0082 (142) | 0.76 | 39 |
| Commuting | Ratio | 7.1092 | -5.7602 (60) | 0.72 | 79 |
| | Diff. | 1.0696 | -0.0117 (73) | 0.81 | 74 |
| Tourist/others | Ratio | 7.4604 | -6.1532 (87) | 0.60 | 79 |
| | Diff. | 1.3436 | -0.0076 (90) | 0.61 | 79 |

**(c) Rail versus bus mode-split model coefficients**

| Purpose | Model | $B_0$ | $B_1$ | $r^2$ | % rail |
|---|---|---|---|---|---|
| Business | Ratio | 6.6641 | -4.6676 (16) | 0.51 | 88 |
| | Diff. | 1.6535 | -0.0085 (14) | 0.45 | 84 |
| Commuting | Ratio | 5.2573 | -5.0354 (9) | 0.39 | 56 |
| | Diff. | -0.1252 | -0.0073 (9) | 0.40 | 47 |
| Tourist/others | Ratio | 3.8830 | -3.9581 (30) | 0.43 | 48 |
| | Diff. | -0.0169 | -1.0070 (34) | 0.49 | 49 |

In addition, it was felt that structural intra- and interprovincial differences in modal usage could be captured through the use of two provincial dummy variables, $I_O$ and $I_Q$, defined equal to one if the trip was an intra-provincial trip within Ontario and Quebec, respectively. Introduction of these provincial dummy variables, plus the use of the inclusive value terms described above resulted in the final version of the model or HORIZONS II. Table 4-18 presents the estimation results for the final model version. Points to note from this table include the following:

- In comparing the final model $r^2$ values with those of the interim model (Table 4-17), it is seen that the goodness-of-fit has improved considerably relative to the interim difference models (which generally had rather poor goodness-of-fit values), as well as relative to the interim ratio models (which tended to out-perform the interim difference models but which had consistently lower values relative to the final model).
- A few of the $\phi$ values estimated are greater than 1.0. This indicates that the decision structure is possibly mis-specified. Ideally, alternative decision structures should be investigated in such cases. For example, perhaps bus should be first split off from the other two higher-quality modes (that is, air and rail). It does not appear that such alternative structures were investigated.
- It is interesting to note that the public versus private commuter model $\phi$ value is essentially 1.0. This implies that a joint model could replace the assumed nested model; that is, that a simpler multinomial logit model defined across the car and common carrier modes would work as well. Given that the commuter market is presumably approaching the intra-urban market in characteristics, and given that the multinomial logit model often is found to work quite well in the intra-urban case, this perhaps provides some validation of the approach adopted.

Table 4-19 presents a comparison of the interim model forecast results versus the final model forecasts (with and without the provincial dummy variables) for one test case. From this table it is seen that the replacement of the weighted average generalized costs with the logsum terms results in a significant shift in predicted usage away from the car mode to the common carrier modes, with the majority of this shift going to the rail mode. The impact of the provincial dummy variables is less dramatic but still noticeable. In this case, it deflates the predicted rail mode share by roughly 10%. The net effect of these two changes is a final model mode split for the inter-provincial Toronto–Montreal market which is not overly different from the interim model results (for example, 45.4% rail mode share versus 42.0%), whereas the final model intra-provincial results are considerably different from the interim model values (for example, 28.5% final rail mode share for Toronto–Ottawa versus the interim value of 20.5%).

*Table 4-18*

## ESTIMATION RESULTS, FINAL HORIZONS MODEL

| **I. Mode-split equations** | | |
|---|---|---|
| | **Rail versus bus level** | $r^2$ |
| Business | $\ln(P_{rail}/P_{bus}) = 3.092 + 0.420 I_O - 1.620 I_Q - 0.00541 GC_{rail} + 0.00286 GC_{bus}$<br>(2.3) (12) (7) (4) | 0.73 |
| Commuter | $\ln(P_{rail}/P_{bus}) = 1.594 - 0.00724 GC_{rail} + 0.00724 GC_{bus}$<br>(36) (24) | 0.91 |
| Other | $\ln(P_{rail}/P_{bus}) = -0.249 + 0.442 I_O - 1.588 I_Q - 0.00241 C_{rail} + 0.00227 GC_{bus}$<br>(6) (27) (14) (14) | 0.69 |
| | **Surface versus air level** | |
| Business | $\ln(P_{sur}/P_{air}) = -10.177 + 0.220 I_O + 3.328 I_Q + 1.444 U_{sur} + 0.0171 GC_{air}$<br>(9) (143) (145) (92) | 0.87 |
| Commuter | $\ln(P_{sur}/P_{air}) = -8.867 + 1.585 I_O + 1.511 I_Q + 0.582 U_{sur} + 0.0199 GC_{air}$<br>(11) (10) (52) (101) | 0.90 |
| Other | $\ln(P_{sur}/P_{air}) = -4.850 + 1.983 I_O + 2.710 I_Q + 1.677 U_{sur} + 0.00807 GC_{air}$<br>(54) (93) (54) (42) | 0.72 |
| | **Public versus private level** | |
| Business | $\ln(P_{pub}/P_{car}) = -8.105 + 0.698 I_O + 2.306 I_Q + 0.893 U_{pub} + 0.0146 GC_{car}$<br>(13) (42) (74) (128) | 0.83 |
| Commuter | $\ln(P_{pub}/P_{car}) = -6.782 + 1.134 I_O + 0.849 I_Q + 1.079 U_{pub} + 0.0291 GC_{car}$<br>(11) (9) (58) (101) | 0.84 |
| Other | $\ln(P_{pub}/P_{car}) = -3.957 + 0.143 I_O + 1.958 I_Q + 0.722 U_{pub} + 0.0101 GC_{car}$<br>(3) (49) (78) (99) | 0.69 |
| **II. Total demand equations** | | |
| Business | $\ln(\text{trips}) = -15.775 - 0.230 I_O + 2.013 I_Q + 1.647 U_{TOT} + 1.036 \ln(\text{emp*inc})$<br>(0.9) (7) (21) (11) | 0.77 |
| Commuter | $\ln(\text{trips}) = -15.756 - 0.346 I_O - 0.369 I_Q + 0.732 U_{TOT} + 1.077 \ln(\text{emp*inc})$<br>(0.9) (0.8) (19) (8) | 0.75 |
| Other | $\ln(\text{trips}) = -14.759 + 0.306 I_O + 1.731 I_Q + 0.907 U_{TOT} + 1.043 \ln(\text{emp*inc})$<br>(1.6) (8) (27) (12) | 0.85 |

**Note:** **Values for *t*-statistics in parentheses.**

*Table 4-19*

### COMPARISON OF FORECAST RESULTS, INTERIM AND FINAL HORIZONS MODELS

| | Projected market shares (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Toronto–Ottawa | | | | Toronto–Montreal | | | |
| **Model** | **Rail** | **Air** | **Car** | **Bus** | **Rail** | **Air** | **Car** | **Bus** |
| Base year | 4.1 | 22.7 | 64.0 | 9.2 | 14.8 | 39.2 | 41.3 | 4.7 |
| Interim HORIZONS model (with base year weighting) | 20.5 | 14.5 | 61.4 | 3.7 | 42.0 | 21.6 | 33.2 | 3.2 |
| Logsum utility approach | 31.6 | 15.6 | 46.1 | 6.7 | 51.1 | 22.7 | 23.0 | 3.1 |
| Logsum model (enhanced with provincial indicators) | 28.5 | 15.5 | 47.2 | 8.8 | 45.4 | 25.0 | 26.2 | 3.5 |

**Notes: Strategy: Rail frequency of 24 one-way trains daily. Rail in-vehicle time cut in half. Other modes unchanged. Implementation year — 1987.**

Finally, Table 4-20 presents value of time, frequency and "reliability" computed for the Windsor–Quebec City corridor from the attitude survey/trade-off analysis approach described under the COMPASS model. Averaging over the two computation methods yields the values shown in Table 4-21, which are compared with similar results obtained for other North American intercity travel corridors.

## Table 4-20

## VALUE OF TIME, FREQUENCY AND RELIABILITY, HORIZONS MODEL (1988 CAN.$/HOUR)

| | Business | | Commuter | | Tourist | | Other purpose | |
|---|---|---|---|---|---|---|---|---|
| | Method 1 | Method 2 | Method 1 | Method 2 | Method 1 | Method 2 | Method 1 | Method 2 |
| | **Value of time** | | | | | | | |
| Rail | 25.2 | 40.4 | 17.8 | 24.0 | 19.6 | 26.9 | 16.0 | 23.4 |
| Air | 62.4 | 69.0 | 53.5 | 44.7 | 26.4 | 32.3 | 24.1 | 30.4 |
| Bus | 21.6 | 14.8 | 12.8[a] | 11.0[a] | 11.1 | 18.2 | 10.5 | 15.9 |
| Car | 25.8 | 30.2 | 13.2 | 24.1 | 16.4 | 23.4 | 15.6 | 21.4 |
| | **Value of frequency** | | | | | | | |
| Rail | 15.0 | 18.7 | 8.2 | 13.5 | 12.0 | 15.5 | 8.5 | 14.5 |
| Air | 31.7 | 36.4 | 9.8 | 30.7[a] | 20.7 | 25.8 | 17.2 | 23.9 |
| Bus | 13.1 | 15.4 | 7.0[a] | 7.4[a] | 7.9 | 12.7 | 7.0 | 13.4 |
| Car | 14.5 | 18.0 | 7.8 | 13.8 | 10.2 | 13.6 | 9.0 | 13.5 |
| | **Value of reliability** | | | | | | | |
| Rail | 49.8 | 64.9 | 29.4 | 48.4 | 30.6 | 61.2 | 30.6 | 57.5 |
| Air | 72.0 | 86.0 | 39.0 | 31.9[a] | 46.2 | 58.7 | 42.6 | 56.4 |
| Bus | 46.8 | 56.0 | 23.4[a] | | 31.8 | 53.4 | 26.4 | 50.1 |
| Car | 44.4 | 58.6 | 27.0 | | 30.0 | 51.0 | 31.8 | 53.7 |

[a] **Less than five valid surveys in each cell.**

## Table 4-21

## COMPARISON OF VALUES OF TIME AND FREQUENCY (1988 CAN.$/HOUR)

| | Value of time | | | | Value of frequency | | | |
|---|---|---|---|---|---|---|---|---|
| | Ont./Que. | N.Y. | Ill. | Ohio | Ont./Que. | N.Y. | Ill. | Ohio |
| **Rail** | | | | | | | | |
| Business | 27.8 | 28.9 | 30.6 | — | 16.9 | 11.9 | 6.4 | — |
| Non-business | 21.3 | 23.4 | 14.6 | — | 12.0 | 8.0 | 4.6 | — |
| **Air** | | | | | | | | |
| Business | 65.7 | 56.6 | 59.8 | 29.6 | 34.1 | 26.5 | 12.6 | 10.9 |
| Non-business | 35.2 | 35.7 | 20.4 | 24.4 | 23.0 | 3.1 | 7.9 | 8.2 |
| **Bus** | | | | | | | | |
| Business | 18.2 | — | — | — | 14.3 | — | — | — |
| Non-business | 13.3 | 35.7 | — | 11.9 | 9.2 | 10.6 | — | 5.5 |
| **Car** | | | | | | | | |
| Business | 28.0 | 29.5 | 25.5 | 17.8 | 16.3 | 14.6 | 6.3 | 6.2 |
| Non-business | 19.0 | 29.5 | 15.3 | 14.8 | 11.3 | 13.3 | 4.1 | 4.5 |

**Note :** **Values from previous studies were adjusted for inflation using published CPI figures and, where necessary, converted to Canadian dollars using U.S.$1.00 = Can.$1.23.**

### 4.5.2 The CRA Model[39]

The starting point for the development of the Charles River Associates (CRA) model consists of the following observations:

- As has been noted several times in this report, the constant cross-elasticity (IIA) assumption of the simple multinomial logit model appears overly strong and unrealistic for the intercity mode choice case. Introduction of high-speed rail, for example, is unlikely to divert travellers in equal proportions from the competing modes.
- Brand et al. (1991) argue that nested logit models do not satisfactorily resolve this problem, since they still assume constant cross-elasticities *within* a given level of the decision structure (for example, in the HORIZONS/COMPASS formulation, between air and surface modes).
- Given that car, air and bus users are observed to possess very different values of time, frequency, etc. (compare Tables 4-11, 4-20, etc.), it can be expected that current users of *each* of these modes will divert to rail at various rates with respect to various types of rail service changes (that is, time-cost-frequency combinations). Further, the nature of travellers' values of times, elasticities, etc., are revealed through the fact that they are observed (or, in forecast mode, predicted) to have chosen a given mode. Thus, for example, we know that current car users will be quite cost sensitive but relatively time insensitive (as well as sensitive to factors such as departure flexibility, ability to carry luggage, etc.), and hence more likely to divert to moderately priced rail options than more expensive options. Conversely, air travellers are generally more time sensitive and less cost sensitive and hence will be more responsive to changes in rail travel times than fares. Presumably, therefore, an approach which directly captures these trade-offs within these different sub-markets will perform better than one which only captures the average response of the aggregated market.

Given these observations, the CRA model uses "direct" demand models to predict the origin-destination flows by mode for each of the air, car and (if available) bus modes, in the absence of high-speed rail. Bimodal logit models are then used to predict the diversion from each of these modes to high-speed rail, given the introduction of this mode (induced high-speed rail trips are generated as a separate calculation, making use of the behavioural relationships identified in the direct demand and mode-split models). In other words, three separate logit models are used to estimate the rail–car, rail–air and rail–bus competition.

Choice-based, stated preference survey methods are used to elicit the trade-offs between car, air and bus users' current modal attributes and high-speed rail attributes required to estimate the logit models' parameters. Model estimation results are shown in Table 4-22. As indicated, each model consists of cost and time terms plus a high-speed rail constant. Thus, the probability $P_{HSR|mp}$ of a traveller choosing high-speed rail in this model, given original mode $m$ and trip purpose $p$, is given by:

$$P_{HSR|mp} = \frac{\exp(\alpha_{mp} + \beta_{mp}C_{HSR} + \gamma_{mp}T_{HSR})}{\exp(\alpha_{mp} + \beta_{mp}C_{HSR} + \gamma_{mp}T_{HSR}) + \exp(\alpha_{mp} + \beta_{mp}C_m + \gamma_{mp}T_m)} \qquad [4.17]$$

where:

$C_k$ = travel cost, mode $k$ ($k$ = HSR, $m$)

$T_k$ = composite travel time, mode $k$ ($k$ = HSR, $m$)

$\alpha_{mp}$, = high-speed rail constant, original mode $m$, trip purpose $p$

$\beta_{mp}$, $\gamma_{mp}$ = cost and time coefficients, original mode $m$, trip purpose $p$

Table 4-22

ESTIMATION RESULTS, CRA MODEL

| | **Coefficients** | | | |
|---|---|---|---|---|
| | **Air** | | **Car** | |
| | **Business** | **Non-business** | **Business** | **Non-business** |
| Cost (1990$) | −0.0379<br>(−4.5) | −0.0609<br>(−4.2) | −0.0283<br>(−2.2) | −0.0321<br>(−3.3) |
| Composite time (h)[a] | −1.3444<br>(−6.4) | −1.723<br>(−5.3) | −0.5636<br>(−3.4) | −0.2817<br>(−2.5) |
| HSR constant[b] | −0.0599<br>(−0.4) | 0.3326<br>(1.7) | −0.771<br>(−1.2) | −1.1967<br>(−2.3) |

**a. Composite travel time = line-haul time + 0.667(access + egress time) + 0.5(wait time).**

**b. HSR = high-speed rail.**

**Note: Numbers in parentheses are *t*-statistics.**

Tables 4-23 and 4-24 present values of time and high-speed rail direct elasticities computed from the model as recently calibrated for the "Texas triangle" (Dallas–Houston–Austin–San Antonio). Table 4-23 presents values of time disaggregated by current mode (air and car; bus is not a factor in this market), trip purpose (business, non-business) and time component (line-haul and access/egress). It is interesting to note that access/egress time values are *less* than the line-haul values, contrary to the typical urban case (as well as contrary to the HORIZONS/COMPASS assumption). Brand et al. (1991) observe that the intercity case differs from the urban case in that competition exists at the line-haul level. In addition, a significant difference in scale exists between the two time components, especially as trip lengths increase. Both of these factors, it is argued, contribute to travellers placing a higher value on line-haul than access/egress time.

*Table 4-23*

*IMPLIED VALUES OF TRAVEL TIME BY MODE AND TRIP PURPOSE IN TEXAS, CRA MODEL (1990 U.S.$/HOUR)*

| | Trip purpose | | | |
|---|---|---|---|---|
| | Business | | Non-business | |
| Current mode | Line-haul time | Access/ egress time | Line-haul time | Access/ egress time |
| **Air** | | | | |
| Value of time ($/h) | 35 | 24 | 28 | 19 |
| Fraction of hourly wage rate | (1.3) | (0.9) | (1.5) | (1.0) |
| **Car** | | | | |
| Value of time ($/h) | 20 | 13 | $9 | 6 |
| Fraction of hourly wage rate | (1.0) | (0.7) | (0.5) | (0.3) |

The elasticities presented in Table 4-24 are computed for the Houston–Dallas route, based on proposed downtown stations and a rail fare set at two-thirds the air fare. The air business elasticity of –0.86 rises to over 1.0 in magnitude as rail fares are set equal to air fares. Similarly, the air non-business elasticity rises to a value of –1.0 at a rail fare of about 90 percent of the non-business air fare. Conversely, car users are already marginally fare-elastic at the two-thirds air fare value. Finally, note the relative inelasticity of rail access/egress time in this model for the 240 mile (380 km) trip being analyzed.

*Table 4-24*

*HIGH-SPEED RAIL ELASTICITIES BY MODE AND TRIP PURPOSE IN TEXAS, CRA MODEL*

| Mode and trip purpose | HSR elasticities[a] | | |
|---|---|---|---|
| | Line-haul time | Access/egress time | Fare |
| **Air** | | | |
| Business | –0.86 | –0.36 | –0.81 |
| Non-business | –0.85 | –0.37 | –0.74 |
| **Car** | | | |
| Business | –0.61 | –0.21 | –1.02 |
| Non-business | –0.38 | –0.14 | –1.05 |

a. **Calculated for characteristics between Houston and Dallas assuming that high-speed rail fares are two-thirds the air fare.**

# 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 INTRODUCTION

This section summarizes the material presented in the previous sections with respect to the following key issues:

- findings concerning demand elasticities, values of time, etc. and their implications with respect to modal substitutability;
- findings concerning selection of functional form and modelling approach; and
- suggestions concerning fruitful directions for future Canadian intercity passenger travel demand modelling.

## 5.2 VALUE OF TIME, DEMAND ELASTICITIES AND MODEL SUBSTITUTABILITY

### 5.2.1 Value of Time

A comparison of values of time (VOTs) estimated by the HORIZONS/COMPASS modelling system (Table 4-14) and those estimated by the CRA model (Table 4-23) are generally comparable, despite differences in methodology. In particular, note that the CRA air and car line-haul VOTs are both derived from binary logit models involving rail as the second mode. This implies that the average rail mode VOT presumably lies in the range of $20 to $35 for business travel and $9 to $28 for non-business travel — values which nicely bracket the HORIZONS/COMPASS rail mode VOTs reported in Table 4-14. Similarly, the CRA line-haul VOTs for both car business and non-business and air non-business are reasonably consistent with the HORIZONS/COMPASS values, especially given the relatively short travel distances within the Texas corridor (that is, VOTs generally increase with trip length). The CRA air business VOT is, however, low relative to the HORIZONS/COMPASS values. Note that these comparisons are based on VOTs expressed in 1990 U.S. dollars.

Tables 4-9(a) and 4-21 provide a comparison of VOTs calculated using the PM multinomial logit model and the HORIZONS model calibrated to the same 1988 data base for the Windsor–Quebec City corridor (the "Ont./Que." column in Table 4-21). In this case, both tables express VOTs in 1988 Canadian dollars. Comparison between these two tables is difficult to make, given that the PM model disaggregates VOT by income (in addition to trip purpose) while the HORIZONS model disaggregates VOT by mode and purpose. In general, however, it appears that the PM model generates line-haul VOTs that are significantly lower than the HORIZONS model values. For example, the PM business line-haul VOTs range from $7 for low-income travellers to $25 for high-income travellers, whereas the range in VOTs across modes in the HORIZONS model is $18.20 (for bus) to $65.70 (for air), with both car and rail VOTs being higher than the PM upper bound of $25 (that is, $28.00 and $27.80, respectively). Similarly, the PM non-business range is from $3 to $13, which lies entirely below the HORIZONS non-business range of $13.30 to $35.20. Conversely, the PM access/egress VOTs are three to seven times higher than the line-haul VOTs, compared to the assumed ratio of two in the HORIZONS model.

Even without adjusting for inflation, it is clear that the Wilson et al. model VOTs (expressed in 1984 Canadian dollars) of $11.02 (business) and $0.03 (non-business) are significantly low relative to all three of the other models just discussed. Similarly, the Ridout–Miller non-business VOTs are significantly low relative to these models. The Ridout–Miller business VOTs, however, are not inconsistent with the more recent results discussed above, especially for higher income levels characteristic of business travellers (see subsection 4.4.2).

Thus, a certain degree of consistency in VOT estimates can be found across the models reviewed, especially if one "adjusts" for the various methodological differences (and differences in strengths and weaknesses) which exist in these models. In particular, the HORIZONS VOTs reported in Tables 4-14 and 4-21[40] possess considerable face validity in that they not only compare well with values estimated using the same modelling method in other corridors, but they also generally compare well with values generated by applying significantly different methods to the modelling of Windsor–Quebec City mode choice behaviour.

### 5.2.2 Demand Elasticities

In general, elasticities could not be computed from the information provided in the papers and reports reviewed. The one notable exception to this rule is the PM model, for which sufficient information was provided to compute elasticities for the Toronto–Montreal route based on 1987 operating conditions. Otherwise, this review is dependent on elasticities reported in the papers and reports reviewed. Unfortunately, only one model reviewed in Section 4 (the CRA model) has any reported elasticities (see Table 4-24). All other elasticities reported are for the aggregate models discussed in Section 3. Table 5-1 summarizes these aggregate results, plus the PM model calculations. Points to note from Tables 4-24 and 5-1 include the following:

- Both the Gaudry–Wills and the Oum–Gillen models indicate that intercity direct fare elasticities are greater than 1.0 in magnitude (that is, that demand is fare elastic). The Gaudry–Wills results indicate a much higher fare elasticity for bus and rail modes than do the Oum–Gillen results.
- The Gaudry–Wills results indicate that the car and air modes are time-inelastic, while the rail and bus modes have larger-magnitude elasticities that may marginally exceed 1.0, depending on the model assumed.
- The CTC elasticities are somewhat consistent with (although generally higher than) the Gaudry–Wills results, despite the much simpler modelling method used in the former model.
- The CRA model time elasticities are not inconsistent with the Gaudry–Wills results, especially given the aggregate nature of the latter.

*Table 5-1*
*INTERCITY MODE SHARE ELASTICITIES, SELECTED MODELS*

**(a) Direct fare elasticites[a]**

| Mode | Gaudry–Wills[b] | Oum–Gillen[c] | CTC[d] | PM[e] |
|---|---|---|---|---|
| Air | 1.87–1.53 | 1.16 | 2.71–2.97 | 1.57–4.50 |
| Rail | 2.84–2.45 | 1.25 | 1.66–2.64 | 1.49–2.06 |
| Bus | 2.91–2.50 | 1.44 | 2.91–3.87 | 1.04–1.31 |
| Car | 1.25–1.08 | —[f] | —[f] | 0.15–2.60 |

**(b) Direct time elasticities[a]**

| Mode | Gaudry–Wills[b] | Oum–Gillen[f] | CTC[d] | PM[e] |
|---|---|---|---|---|
| Air | 0.86–0.83 | — | 0.46–0.62 | 0.14–0.58 |
| Rail | 0.77–1.06 | — | 0.35–1.52 | 0.57–3.82 |
| Bus | 0.77–1.08 | — | 1.44–2.15 | 0.67–4.94 |
| Car | 0.38–0.53 | — | —[f] | 0.11–3.63 |

[a] For convenience of presentation, the negative signs on these elasticities have been deleted.

[b] Obtained from Table 3-4. The first number shown is the CLCS-1 model elasticity; the second is the TLCS-1 value. Elasticities are based on 1972 data and are evaluated at the sample average.

[c] Obtained from Table 3-5 by averaging the 1972 elasticities across the four quarters. Note that these are *expenditure* share elasticities rather than true mode share values.

[d] Obtained from Table 3-1. Range indicates highest and lowest elasticities reported in this table.

[e] Obtained from Table 4-9. Range indicates the highest and lowest elasticities obtained across the trip purpose–income level combinations considered in Table 4-9.

[f] Elasticity not estimable from this model.

- The CRA model, however, indicates that rail fare elasticities tend to be inelastic for current air users, contrary to the aggregate model results. These fare elasticities do, however, increase in magnitude as the rail fare rises towards the air fare level with the cross-over into the elastic range occurring at rail fares which are somewhat less than the competing air fare. Current car users in the CRA model have virtually unit rail fare elasticities, given an assumed rail fare equal to two-thirds the competing air fare.

- The PM model common carrier fare elasticities are reasonably consistent with the aggregate model results, although the variation in both the air and auto mode values seems large relative to the other findings (particularly the CRA model results).

- The variation in PM model time elasticities for the non-air modes seems to be very high relative to the other findings, although the low end of the PM model time elasticities are generally consistent with the other models' values.

Drawing generalized conclusions from such scattered results obtained from such different models is clearly hazardous at best and quite possibly foolish to undertake. Nevertheless, the following hypotheses, which appear to be consistent with the findings of this review, are advanced:

- Intercity travel demand tends to be time-inelastic. Time elasticities tend to vary from approximately –0.40 to –0.85 depending on the model used and the mode involved. The lower magnitude tends to be characteristic of car-related travel, while the upper level tends to be characteristic of air-related travel.
- Car-related intercity travel demand tends to be slightly cost-elastic, particularly in the rail fare ranges likely to be associated with high-speed rail operations.
- Air-related intercity travel demand tends to be slightly cost-inelastic, unless rail fares approach those for air, in which case demand may become unit-elastic or even slightly elastic.

These hypotheses obviously lean heavily on the CRA model results (in particular with respect to the air-related fare elasticities) and tend to be couched in the CRA model terms. This approach is adopted based on the following considerations:

- Based on the VOT comparisons discussed in subsection 5.2.1, the CRA model appears to yield similar results to currently operational Canadian models of somewhat similar design (for example, HORIZONS). Hence, in the absence of more complete information, the reported CRA elasticities are taken as being representative of this generation of models.
- As noted above, with the exception of the air-related fare elasticity case, the CRA results are reasonably compatible with the earlier Gaudry–Wills results.

- The disaggregate modelling approach is viewed as a theoretically stronger basis for modelling than the very aggregate, statistical/empirical approach represented by the Gaudry–Wills model. Hence, when in doubt, the disaggregate model results will be favoured.

## 5.3 FUNCTIONAL FORM AND MODELLING APPROACH

As is clear from the final point made in the previous section, judgements concerning a modelling approach are inherently dependent upon evaluations of modelling results. This is why so much of this review focusses on methodological considerations: the validity of empirical results cannot be assessed independently of the means by which these results are obtained. In terms of intercity passenger travel demand modelling methods, some fairly clear directions with respect to the evolution of these methods have emerged from this review. These can be summarized by the following observations:

- A minimum level of disaggregation is required to achieve behaviourally plausible, policy-sensitive models. This disaggregation must include the development of separate models for business and non-business purposes (with further disaggregation of the non-business category, as appropriate). The model also must be sufficiently disaggregated spatially to permit reasonable calculations of access and egress travel times and costs by mode.[41]
- With the notable exception of income, few socio-economic variables have been found to affect intercity mode choice in a consistently significant way. While this may partially reflect data deficiencies and/or lack of appropriate model testing procedures, the consistency of this result across every disaggregate model reviewed does seem to indicate some robustness in the finding.[42] This is good news for modellers, in that it reduces the amount of model disaggregation required for model specification and, correspondingly, simplifies the model aggregation/forecasting problem.
- Both aggregate and disaggregate modelling results indicate that the simple multinomial logit model is not an appropriate model formulation for intercity mode choice. The constant cross-elasticity (IIA) assumption of the multinomial logit model is untenable, based both on theoretical principles and empirical observations. Various forms of structured logit-based models are typically used to circumvent the problems inherent in the multinomial logit model.[43] These include:

- the nested logit model (typified by the Koppelman model, subsection 4.4.6);
- the sequential application of hierarchical binary logit models (typified by the HORIZONS/COMPASS family of models, subsection 4.5.1);[44] and
- the use of pairwise (rail versus a competing mode) binary logit mode choice models applied to competing mode travel volumes (the CRA model, subsection 4.5.2).

All three approaches possess various strengths and weaknesses, while the latter two, at least, are representative of the current operational state-of-practice.

- Choice-based survey methods have generally emerged as the survey method of choice for mode-choice modelling, given the greater control which such methods give over survey design as well as the greater efficiency in sample collection that can be achieved.
- The use of stated preference techniques is becoming commonplace as a means of determining plausible values of time, etc., for predicting travellers' responses to the introduction of essentially new services such as high-speed rail.

## 5.4 DIRECTIONS FOR MODEL DEVELOPMENT

Despite the considerable improvements in the intercity demand modelling state-of-the-art which has occurred over the past 20 years, several issues remain which require further investigation if this state-of-the-art is to continue to develop and if the contribution of these models to intercity passenger policy formulation and decision making is to be maximized. In general terms, these issues relate to the need for more systematic, general investigations into alternative model specifications and into the practical as well as statistical performance of these models. More specifically, these issues include the following:

- A need exists to explore intercity travel market segmentation in a more detailed, systematic way than has generally been undertaken. Ridout and Miller (1989) and Abdelwahab et al. (1991) represent examples of very partial attempts to explore this issue, but much more comprehensive investigations involving more detailed data bases are required. The role of trip distance and income as categorizing rather than explanatory variables, car ownership (an almost totally unexplored variable in the intercity context) and seasonal variations in travel choices (again, almost totally unexplored but surely of significant interest in the Canadian context) all require considerable additional investigation.

- A need exists to explore in a consistent way (that is, using the same data base, etc.) the various options for structuring the intercity mode choice process discussed in the previous section. Additional options also exist, including alternative orderings of choices within the binary choice hierarchy.
- A need exists to apply the use of very generalized functional forms (typified by the work of Gaudry) within the context of the structured (partially) disaggregate models characteristic of current operational methods. Computational complexities undoubtedly exist with respect to this approach.[45] Nevertheless, use of such generalized functional forms typically widens the range of "testable" model assumptions and provides useful insights into the extent to which the more restricted functional forms (and, hence, typically the underlying theory generating these restricted functional forms) are adequately capturing observed behaviour.

In general, these identified needs point to the more basic need for treating intercity travel demand modelling as a research task; that is, as a (typically interactive) process of hypothesis formulation and testing designed to improve our understanding of intercity travel behaviour in general and our practical capabilities for predicting future travel behaviour in particular. This approach can be contrasted with the all too common approach adopted in this field in which models are treated as proprietary tools that are designed to promote a particular point of view and that are not open to peer scrutiny and professional, informed debate. Without such scrutiny and debate, however, the modelling state-of-the-art will inevitably fail to achieve its potential, will suffer from a general lack of credibility and, hence, inevitably fail the policy formulation process it is intended to serve.

## ENDNOTES

1. No attempt to review single mode demand models (such as air demand forecasting models) has been made in this study, since these provide little or no information concerning intermodal substitutability. For a recent review of air demand forecasting models, see Hutchinson (1991).

2. For more detailed criticisms of aggregate models, see Rice et al. (1981) and Koppelman et al. (1984).

3. Technically, one rarely observes the probability (frequency) of an individual's modal choice, but rather the choice of a single mode in a single-choice situation. This complicates the model estimation process somewhat but does not alter the basic argument being made here.

4. As is discussed further in subsection 4.4.6, most so-called disaggregate models actually still retain some level of spatial aggregation, primarily due to data limitations. The overall methodological approach, however, is essentially disaggregate in nature.

5. There are exceptions to this generalization. See, for example, subsection 4.4.6, which discusses the Koppelman model. This model involves extension of disaggregate choice theory to the entire intercity travel demand modelling process.

6. See Hartgen and Cohen (1976), Rice et al. (1981) and Koppelman et al. (1984).

7. VIA Rail (1984a, 1984b).

8. Transport Canada/Ministry of Transportation and Communications (1979), Transport Canada (1979).

9. This section is based on Canadian Transport Commission (1970).

10. For a more complete description of the dogit model, see Gaudry and Dagenais (1979).

11. Gaudry and Wills (1979), p. 165.

12. Oum and Gillen (1983), pp. 184-85.

13. For more detailed discussion of disaggregate choice modelling theory, methodology and applications see, for example, Domencich and McFadden (1975), Hensher and Johnson (1981), Kanafani (1983), Manski and McFadden (1984) and Ben-Akiva and Lerman (1985).

14. For more detailed reviews of these models, see Hartgen and Cohen (1976), Rice et al. (1981) and Koppelman et al. (1984).

15. This section is based on Transportation Development Agency (1976).

16. This discussion is based on Ridout (1982) and Ridout and Miller (1989).

17. "Best" is defined in terms of statistical significance and agreement with a priori expectations of the parameter estimates, overall goodness-of-fit of the model and explicit statistical tests comparing the goodness-of-fit of competing model specifications.

18. See, for example, Miller and Cheah (1991).

19. This discussion is based on Wilson et al. (1990).

20. One of the most important differences is the lack of access/egress terms in the Wilson et al. models. This is due to a lack of sufficient information in the CTS data base to compute such terms. This is the single biggest weakness of the CTS data base and is, in fact, the reason why Ridout and Miller did not use it for their modelling work.

21. This discussion is based on Abdelwahab et al. (1991) and Abdelwahab (1990).

22. Updating involves statistically adjusting parameters estimated for one region using (typically limited) information concerning the new region to which the model is to be applied. For discussion of these methods see, for example, Atherton and Ben-Akiva (1976) and Koppelman and Wilmot (1982, 1986).

23. See Abdelwahab (1990) for details of these transferability tests.

24. See, in particular, McCoomb (1983) for a detailed examination of the transferability of urban mode choice models within Canada.

25. This discussion is based on Peat Marwick (1990), Ontario/Quebec Rapid Train Task Force (1991) and Ellis (1990).

26. Such terms are also absent from the Ridout–Miller model, but in this case by definition, since the car mode is excluded from this model.

27. These bias terms are the equivalent of the constant or "*y*-intercept" term in a linear regression equation. In linear regression, the regression line always passes through the point defined by the mean values of the dependent and independent variables. If the *y* intercept is forced through zero, then the other coefficient(s) in the model (representing the slope(s) of the line with respect to the independent variable(s)) will be correspondingly biased. In MLE estimation of logit models, the model always reproduces the aggregate modal shares observed in the estimation sample. If the bias terms are omitted, then the other parameters in the model will be biased, analagous to the regression example.

28. A similar argument might be made for other model parameters, but it is a much less persuasive one. In particular, the new mode's travel times and costs are likely to fall within the overall range of times and costs already experienced by travellers within the system. Thus, the model, if otherwise "properly" constructed, should be capturing these modal service trade-offs adequately. The constants, however, have buried within them the particular set of unobserved characteristics that exist within the current modes. A significantly upgraded or new mode is likely to have quite a different set of these unobserved characteristics and, hence, quite a different modal constant.

29. This can be contrasted with the urban case in which new mode introduction is rarely the issue. Rather, urban models are used to examine alternative expansions of existing modal networks (that is, road and transit), a situation in which the transferability of historical model parameters — including the modal constants — into future contexts is a more readily acceptable assumption.

30. This discussion is based on Koppelman (1989).

31. For more detailed discussions of the nested logit model and its derivation from random utility theory, see, among others, Ben-Akiva and Lerman (1985). In general, the nested logit can be viewed as a generalization of the ordinary logit model that permits complex decision structures to be modelled in a theoretically consistent yet practical way.

32. Koppelman and Hirsh (1986). For a similar discussion of these issues, see Rice et al. (1981).

33. Similar problems exist with publicly available data sets in Canada, as indicated by the difficulties encountered by Ridout and Miller, and Wilson et al. in their modelling efforts. For a detailed discussion of data-related issues in intercity passenger travel demand modelling in Canada, see Miller (1985).

34. This issue exists despite the extensive experience in the market research field with stated preference methods (see, for example, Green and Srinivasan (1978) and Cattin and Wittink (1982)). For a detailed discussion of the strengths and weaknesses of both revealed and stated preference data in travel demand models, see Ben-Akiva et al. (1990).

35. See VIA Rail (1984a, 1984b).

36. This discussion is based on Transportation and Economic Management Systems, Inc. (undated) and Transportation Management Systems, Inc./Benesch (1991).

37. See any text dealing with disaggregate logit models, for example, Ben-Akiva and Lerman (1985).

38. This discussion is based on VIA Rail (1989a, 1989b, 1989c, 1989d).

39. This section is based on Brand et al. (1991).

40. These are the same VOTs. In Table 4-14 they are expressed in 1990 U.S. dollars, while in Table 4-21 they are expressed in their original units of 1988 Canadian dollars.

41. Although not explicitly discussed within the model review chapters, current models typically involve the use of a zone system for each urban area that is sufficiently detailed to permit reasonably accurate access/egress times/costs to be calculated for each intercity travel mode. See, for example, VIA Rail (1989a) and Transportation Economic Management Systems, Inc. (undated). This can be contrasted with earlier, aggregate models in which a single set of average access/egress times/costs for each city-pair would be used.

42. In a West German study not previously referenced in this review, Brog (1982) similarly reported "surprisingly little impact" of socio-demographic variables on personal intercity mode choice behaviour. This result was obtained from a situational approach to the problem, based on detailed attitudinal survey results, rather than on econometric models such as the ones reviewed in this paper. Thus, this result also appears to be relatively robust across analysis methodology.

43. The one significant exception to this statement involves the continuing investigations of Gaudry on the use of aggregate, very generalized functional forms (Gaudry 1989, 1990). This approach does not appear to be popular with the developers of operational intercity models, probably due to the econometric and computational complexities involved. As discussed further in the next section, however, much of this work is potentially transferable to a more disaggregate, operational environment within the structured modelling approach discussed here.

44. As discussed in subsection 4.5.1, this system of models may or may not be consistent with the nested logit model formulation, depending on the model application.

45. Theoretical problems may also exist. In particular, use of these generalized functional forms sometimes implies loosening the ties between the empirical model and microeconomic utility theory which usually underlies the empirical model and which provides the empirical model with much of its a priori plausibility.

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## 20

# PRICE ELASTICITIES OF INTERCITY PASSENGER TRAVEL DEMAND

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## 1. INTRODUCTION[1]

It is readily understood that the demand for air travel between Montreal and Toronto depends on the price of such a trip by airplane and on the prices of other modes of transport. It also depends on personal income, on the populations of Montreal and Toronto and on a host of other factors. When these factors are taken individually, it is easy to demonstrate that each one affects the number of air passengers. Graphs or simple correlations could show that changes in the number of travellers and income go hand in hand, or that there is a negative correlation between the number of passengers and the price of airline tickets.

Since the goal of this analysis is to isolate the influence of price on the number of trips taken, a method that considers all the other factors that also affect air travel must be used. For this reason, of the various ways of studying the reaction of travel demand to prices, only econometric models that measure the influence of different explanatory factors on the use of modes of transport are used in this study.

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This multidimensional approach makes it possible to ask the following question: *Ceteris paribus*, what is the effect of a price increase on travel demand? Because it isolates each explanatory factor, a multivariate mathematical analysis will answer the question.

The review of various econometric models of intercity travel demand deals primarily with the sensitivity of modal demand for passenger travel in relation to price. The reader should keep in mind that these models, as indicated in Section 2, incorporate considerations other than price.

Price elasticity, which can be defined as the percentage change in demand resulting from a 1 percent change in price, is a useful measure of demand sensitivity to price. Travel demand usually has a negative price elasticity: a 1 percent price increase reduces demand by *x* percent. In this study, however, the negative or positive sign is set aside and the absolute value of elasticity is used. Thus, a price elasticity of –3 is greater than a price elasticity of –1.

In this study, different estimates of the effect of prices on intercity travel are compared for the first time. More precisely, demand sensitivity of each mode of transportation (auto, air, rail, bus) are evaluated in relation to the price of each mode. Several intercity passenger travel demand models have been calibrated in the past, resulting in estimates of price elasticities specific to each of those models. These price elasticity estimates are difficult to compare because they are based on different prices and demands.

This review of price elasticities of passenger travel demand makes it possible to answer several questions: Do models calibrated more than 10 years ago still permit the evaluation of current travel demand sensitivity? Which models are applicable to any given market type? Are the price elasticities derived from models sufficiently homogeneous to suggest a "consensus"? Which modes have an elastic travel demand? Which travel demand modes are sensitive to prices of other modes?

The answers can be found in Section 3, which contains an analysis of price elasticities for four Canadian markets. These elasticities are calculated with nine econometric models of intercity passenger travel demand. The method used to compare these demand models is set out in Section 2. It is based on hypotheses whose validity is confirmed in Section 4. The detailed formulas for the nine demand models can be found in Section 5.

# 2. COMPARISON OF MODELS AND MARKET DESCRIPTIONS

As mentioned above, price elasticity of demand for travel usually varies from one market to another. It is expected that price elasticities for the Montreal–Toronto market differ from those for the Toronto–Vancouver market, because the modes of transport have different prices, the level of travel is not the same, etc.

In the empirical literature on travel demand, it is common practice to present price elasticities which have been calculated using the same data as those used to calibrate the econometric model. Price elasticities calculated in this way cannot be compared with the price elasticities of other studies if they are based on different data.

## 2.1 FOUR REPRESENTATIVE MARKETS

To avoid these difficulties, this study presents on a common basis, price elasticities obtained from different mathematical models. This comparative analysis of price elasticities is conducted for four Canadian markets: a representative Canadian market, Montreal–Ottawa, Montreal–Toronto and Toronto–Vancouver. Table 2.1 reports the number of trips per mode ($T_m$), modal shares ($S_m$), the cost of using each mode ($C_m$), the distance (DIST) and the per capita income in the zone of origin ($Y$) in 1976 for each of the four markets. The representative market corresponds to the mean values of the Transport Canada data base which covers trips taken between 155 pairs of Canadian cities in 1976.

The travel demand models examined in this study can be grouped into three large categories: probability models, modal-split or market-share models, and generation-distribution models. A probability model yields the probability that an individual will opt for a mode of transport for an intercity trip. A modal-split model gives the proportion of trips per mode. A generation-distribution model deals with the total number of trips within a market.

When elasticities for a particular market are obtained from aggregate information such as that presented in Table 2.1, no specific methodological difficulties are encountered with the modal-split and generation-distribution models. This is not so for probability models. To understand the method used to calculate elasticities in this study, a brief review of the derivation of elasticities in probability models is necessary.

Table 2.1
INFORMATION BY MARKET (1976)

| | **Representative market** | **Montreal–Ottawa** | **Montreal–Toronto** | **Toronto–Vancouver** |
|---|---|---|---|---|
| Trips per mode: | | | | |
| $T_{auto}$ | 106,650 | 1,710,000 | 899,630 | 1,366 |
| $T_{air}$ | 12,812 | 26,224 | 343,800 | 110,420 |
| $T_{train}$ | 6,257 | 83,561 | 219,530 | 9,271 |
| $T_{bus}$ | 5,633 | 307,740 | 58,500 | 1,144 |
| Modal shares: | | | | |
| $S_{auto}$ | 0.81 | 0.80 | 0.59 | 0.01 |
| $S_{air}$ | 0.10 | 0.01 | 0.23 | 0.90 |
| $S_{train}$ | 0.05 | 0.04 | 0.14 | 0.08 |
| $S_{bus}$ | 0.04 | 0.15 | 0.04 | 0.01 |
| Cost of a trip per mode ($1/100 Canadian, 1976): | | | | |
| $C_{auto}$ | 5,115.5 | 605.0 | 1,662.0 | 14,998.0 |
| $C_{air}$ | 8,335.6 | 3,027.0 | 5,133.0 | 16,475.0 |
| $C_{train}$ | 4,233.5 | 942.0 | 2,366.0 | 10,419.0 |
| $C_{bus}$ | 4,042.6 | 867.0 | 2,000.0 | 8,983.0 |
| Distance (miles): | | | | |
| DIST | 930.2 | 110.0 | 302.0 | 2,727.0 |
| Cost of a trip per mile travelled (cents/mile): | | | | |
| $C_{auto}$/DIST | 5.50 | 5.50 | 5.50 | 5.50 |
| $C_{train}$/DIST | 8.96 | 27.52 | 17.00 | 6.04 |
| $C_{bus}$/DIST | 4.55 | 8.56 | 7.83 | 3.82 |
| $C_{auto}$/DIST | 4.35 | 7.88 | 6.62 | 3.29 |
| Per capita income in the city of origin (Canadian $ 1976): | | | | |
| $Y$ | 4,241.0 | 4,270.4 | 4,270.4 | 4,508.8 |

## 2.2 PROBABILITY MODELS: PRECISE AND APPROXIMATE ELASTICITY MEASUREMENTS

To begin with, a sample consisting of information on modal choices for a group of individuals is required to calibrate or estimate a probability model. Thus, the selected mode, the transportation prices and times for the available modes, various socio-economic characteristics (for example, sex, occupation, age, income, etc.) are known for each individual.

Once the model has been estimated, the elasticity of the demand for mode of transport *m* in relation to its price ($C_m$) can be calculated for each individual *k* in the sample ($\eta^{m}_{C_m}(k)$).

It is then easy to determine the price elasticity of a specific market ($\eta^{m}_{C_m}$ (market)), Montreal–Toronto for example, using the individual elasticities and the weight ($f_k$) of the individuals in the sample:

$$\eta^{m}_{C_m}(\text{market}) = \Sigma_k \eta^{m}_{C_m}(k) \cdot f_k \qquad (2.1)$$

Three pieces of information are usually required to calculate price elasticity for individual *k*: a parameter ($\beta$), the price of the travel by mode *m* for individual ($C_m(k)$), and the probability that individual *k* will not choose mode *m* ($1 - \text{prob}_m(k)$). More precisely:[2]

$$\eta^{m}_{C_m}(k) = \beta \cdot C_m(k) \cdot (1 - \text{prob}_m(k)) \qquad (2.2)$$

Therefore, aggregate elasticity is derived as a weighted sum of individual elasticities. This "enumeration method" for calculating aggregate elasticities requires the sample that was used to calibrate the model. A comparison of the elasticities from models that use different samples becomes very tedious and prevents the type of analysis envisaged here. Another solution must be considered.

For example, to obtain aggregate elasticities for the Montreal–Toronto market, without the sample that was used for calibration, it is suggested that an approximation of aggregate price elasticity be used ($\eta^{m}_{C_m}$ (approx.)). Equation (2.2) for an individual's price elasticity is used, replacing the price ($C_m(k)$) of individual *k* with a representative market price ($\overline{C_m}$). The market share of the other modes, $1 - S_m$, is substituted for $1 - \text{prob}_m(k)$, the probability that mode *m* will not be chosen:

$$\eta^{m}_{C_m}(\text{approx.}) = \beta \cdot \overline{C_m} \cdot (1 - S_m) \qquad (2.3)$$

When (2.3) is compared with the two preceding equations, it becomes obvious that this approximation greatly simplifies the calculation of price elasticities because:

- Price elasticity with equation (2.3) only requires a single value for the price of each mode ($\overline{C_m}$);
- The approximation of aggregate price elasticity ($\eta^{m}_{C_m}$ (approx.)) is based on the observed market share ($S_m$) rather than on the calculated share ($\text{prob}_m(k)$).

Instead of first calculating elasticities for each individual in the sample and then taking a measured average of those elasticities, approximation involves directly calculating one aggregate elasticity with a mean price and the observed market share. Section 4 contains two examples that show that the difference between precise aggregate elasticities ($\eta^{m}_{C_m}$ (market)) and those obtained from the approximation ($\eta^{m}_{C_m}$ (approx.)) is small. For this reason, and because approximation simplifies the calculations, it is felt that such an approximation is useful. Otherwise it would not be possible to compare the elasticities obtained from aggregate and disaggregate models. It would not even be possible to compare elasticities obtained from two disaggregate models!

## 3. PRICE ELASTICITIES OF PASSENGER TRAVEL DEMAND

In this section, price elasticities are calculated for four Canadian markets, using nine demand models. The market situation corresponds to that in 1976. This year was selected because it is the latest year for which information on intercity travel by all modes of transport in Canada is available.

The demand models to be examined are:

Probability models:

- Grayson (1981)

- HORIZONS (1989)
- Peat-Marwick (1990)
- Ridout-Miller (1989)
- Wilson et al. (1990)
- Stopher-Prashker (1976)

Modal-split models:

- PERAM
- SLAG (1977)
- Gaudry-Wills (1978)

Generation-distribution models:

- HORIZONS (1989)
- Peat-Marwick (1990)
- PERAM
- SLAG (1977)
- Gaudry-Wills (1978)

The parameters of all models other than those of Grayson and Stopher-Prashker have been estimated using Canadian data obtained from three different sources: Transport Canada, Canadian Travel Survey (CTS) and VIA Rail. The data from Transport Canada date back to 1972 and were used to calibrate the SLAG and Gaudry-Wills models. The PERAM model is based on a 1976 Transport Canada data base. The Ridout-Miller and Wilson et al. models are estimated using CTS data for the years 1968 and 1982, respectively. Finally, the Peat-Marwick and HORIZONS models are based on 1987 VIA Rail data.

## 3.1 PROPERTIES OF THE MODELS

Before proceeding with a market-by-market analysis of price elasticities, it is useful to discuss some properties of the econometric models used in this study. Section 5 contains a more formal presentation of the models.

### 3.1.1 The Influence of Prices and Market Shares on Price Elasticities

The number of trips per mode of transport can be expressed as the product of the total number of trips by all modes of transport and the share of each mode in total trips. It follows that the price elasticity of the demand for trips by mode $m$ ($\eta^m$ (mode)) is necessarily equal to the sum of the price elasticity of total demand ($\eta$ (total)) and the price elasticity of the share of mode $m$ in total trips ($\eta^m$ (share)),[3]

$$\boxed{\eta^m(\text{mode}) = \eta(\text{total}) + \eta^m(\text{share}) \qquad (3.1)}$$

Price elasticities of the modal share ($\eta^m$ (share)) are evaluated using probability or modal-split models, while price elasticities of total demand ($\eta$ (total)) are obtained from generation-distribution models. In this section, certain properties of price elasticities of the modal share ($\eta^m$ (share)) and total demand ($\eta$ (total)) are examined.

As a rule, price elasticities of the shares are calculated using three elements: parameter $\beta$, market share ($S_m$) and the cost ($C_m$). The price elasticity of the linear logit model (see equation (2.3) is an example of expression (3.2).

$$(\beta, S_m, C_m) \rightarrow \eta^m(\text{share}) \qquad (3.2)$$

It is also true (as shown in Section 5) that total elasticities also depend on parameter $\gamma$, shares and price levels.

$$(\gamma, S_m, C_m) \rightarrow \eta(\text{total}) \qquad (3.3)$$

It follows that price elasticities of a particular mode ($\eta^m$ (mode)) vary from one market to another because prices and market shares differ. The separate effect of market share (share effect) and of the mode's cost (price effect) on price elasticities is discussed below.[4]

### A. Share Effect on Price Elasticities of the Modal Share

*Own Elasticities:* As far as the relationship between price elasticities and modal shares is concerned, all models mentioned above imply that direct price elasticity ($\eta^{m}_{C_m}$ (share)) of the modal share decreases as the share of mode *m* increases ($S_m$). *Ceteris paribus* the greater the modal share, the less sensitive the modal share is to that mode's cost ($C_m$). This first property is termed P.1.

$$\boxed{\Delta^{+}S_m \quad \rightarrow \quad \Delta^{-}\eta^{m}_{C_m}(\text{share})} \qquad \text{P.1}$$

*Cross Elasticities:* Cross price elasticities ($\eta^{m}_{C_l}$ (share)) are directly proportional to the share of the mode ($S_l$) whose price ($C_l$) is changing. That is, the price elasticity of mode *m* with respect to the price of mode *l* increases as the share of mode *l* increases. If mode *l* has a large share, then, according to property P.1, it will not adjust by much in response to a change in its own price; the other modes of transport will adjust more. This implies another property:

$$\boxed{\Delta^{+}S_l \quad \rightarrow \quad \Delta^{+}\eta^{m}_{C_l}(\text{share})} \qquad \text{P.2}$$

### B. Share Effect on the Price Elasticity of Total Demand

Total travel demand elasticities ($\eta$(total)), with respect to the cost of the modes of transport, are directly proportional to modal shares. The larger the market share, the higher the sensitivity of total demand to changes in the price of the mode in question. At the limit, total demand will not be affected at all by changes in the price of a mode whose market share is zero.

$$\boxed{\Delta^{+}S_m \quad \rightarrow \quad \Delta^{+}\eta_{C_m}(\text{total})} \qquad \text{P.3}$$

### C. Price Effect on Price Elasticities of the Modal Share

It has been shown that the share effect on price elasticities is the same for all the models examined: cross elasticity of the modal share and elasticity of total demand increase, and direct elasticity of the modal share decreases as modal share increases. The same does not hold true for changes in a mode's price. In fact, as a mode's price increases, price elasticities may increase, decrease or remain unchanged depending on the model examined.

*A priori,* it is expected that the price elasticity of the modal share increases as the price increases. The Peat-Marwick, Ridout-Miller, HORIZONS, Grayson and Stopher-Prashker models conform to this rule for direct and cross elasticities.

$$\boxed{\Delta^{+}C_m \rightarrow \Delta^{+}\eta^{m}_{C_m}(\text{share}), \quad \Delta^{+}\eta^{l}_{C_m}(\text{share})} \qquad \text{P.4}$$

Price elasticities of modal shares for the PERAM and SLAG models are invariant with the price of modes. Since these elasticities reflect the sample's estimation conditions, comparing them with other models can reveal surprises for prices that differ too much from the sample averages.

$$\boxed{\Delta^{+}C_m \rightarrow \eta^{m}_{C_m}(\text{share})\text{ constant, }\eta^{l}_{C_m}(\text{share})\text{ constant}} \qquad \text{P.5}$$

Price elasticities of the Gaudry-Wills and Wilson et al. models decrease as the price increases. The cost of a mode in the Wilson et al. model corresponds to the cost of a trip divided by the distance travelled. (It is interesting to note that Wilson et al. (1990) refer to this variable as the unit cost of travel.) The result follows if, as is the case for the markets studied, the cost of use per unit of distance decreases as the distance increases (see Table 2.1). The Gaudry-Wills model specifies the mode's cost as an explanatory variable, but the Box-Cox transformation applied to it implies the same result.[5]

$$\boxed{\Delta^{+}C_m \rightarrow \Delta^{-}\eta^{m}_{C_m}(\text{share}), \quad \Delta^{-}\eta^{l}_{C_m}(\text{share})} \qquad \text{P.6}$$

*Discussion:* It is reasonable that the share price elasticity increases as the price increases. Knowing that price must represent the cost per unit of obtaining a good, the question is whether the price should be defined per unit of distance or by market. The answer depends on how one defines a consumer good: Is the demanded good a quantity of distance or a number of trips in a given market? It seems that this issue, which deals with the very formulation of intercity demand models, has not been given the attention it deserves.

Due to the difficulty of this issue, it is felt that an in-depth discussion is beyond the scope of this study. Some answers, however, can be found in Dagenais and Gaudry (1986). It is interesting to note that the Box-Cox transformation approach of the Gaudry-Wills model avoids the question somewhat by letting the data decide the formulation.

*D. Price Effect on Price Elasticity of Total Demand*

The price effect on the price elasticity of total demand is similar to the price effect on the price elasticity of the modal share. Thus, price elasticities of total demand for the Peat-Marwick and HORIZONS generation-distribution models increase as the mode's cost increases (in a manner similar to P.4). The PERAM and SLAG generation-distribution models generate total demand price elasticities that are not affected by price (in a manner similar to P.5). Total demand price elasticities of the Gaudry-Wills generation-distribution model decrease as the mode's price increases (in a manner similar to P.6). This result can be explained by the fact that equations that involve the costs of modes are similar in the generation-distribution and modal-split models.

Properties P.4, P.5 and P.6 can therefore be rewritten by substituting the term "total" for the term "share," calling the formulas P.4*, P.5* and P.6* and associating them with the same sub-groups of models.

### 3.1.2 Cross Elasticities

The preceding section dealt with the causes of variations in price elasticities from one market to another. Attention is now focussed on the properties of cross elasticities for the models examined, irrespective of the market studied.

Except for the HORIZONS model, one of the special features of the demand models considered in this study is the equality of cross price elasticities of modal shares.

$$\boxed{\begin{aligned}
\eta^{air}_{C_{auto}}(\text{share}) &= \eta^{rail}_{C_{auto}}(\text{share}) = \eta^{bus}_{C_{auto}}(\text{share})\\
\eta^{auto}_{C_{air}}(\text{share}) &= \eta^{rail}_{C_{air}}(\text{share}) = \eta^{bus}_{C_{air}}(\text{share})\\
\eta^{auto}_{C_{rail}}(\text{share}) &= \eta^{air}_{C_{rail}}(\text{share}) = \eta^{bus}_{C_{rail}}(\text{share})\\
\eta^{auto}_{C_{bus}}(\text{share}) &= \eta^{air}_{C_{bus}}(\text{share}) = \eta^{rail}_{C_{bus}}(\text{share})
\end{aligned}} \qquad \text{P.7}$$

### 3.1.3 Modal Substitution Index

Cross price elasticities of modes of transport are used to address the issue of substitutability between modes of transport. However, it can be somewhat difficult to interpret these price elasticities. When there is substitution between modes, the cross price elasticity reveals, for example, that an increase in the cost of the bus mode will increase the demand for other modes of transport by a certain percentage. However, the cumulative significance of these diversions in relation to a change in demand for the bus mode is not clear. A modal substitution index has been developed to facilitate discussion of the subject.

There are two components to the change in demand for a mode: on the one hand, there is a diversion or modal substitution effect; on the other, there is an induced demand or an adjustment in the total travel demand. The modal substitution index indicates the percentage of the change in demand for the mode that is associated with the substitution effect. For example, a modal substitution index of 0.75 for travel by bus implies that if the cost of the bus mode decreases, 75 percent of the increase in the number of bus travellers results from a diversion or a decrease in demand for other modes of transport, and 25 percent of the increase in demand for the bus mode is induced (total) demand.

Formally, the modal substitution index for mode m ($\theta^{s}_{m}$) is calculated using the market share of mode m, the elasticities of total demand and demand for mode m with respect to the cost of mode m.

$$\theta^{s}_{m} = 1 - \frac{\eta_{C_m}(\text{total})}{\eta^{m}_{C_m}(\text{mode})\ S_m} \tag{3.4}$$

Subsection 5.2 shows the derivation of the modal substitution index. After a few transformations, the modal substitution index may also be written as follows:

$$\theta^{s}_{m} = \frac{1 - S_m}{1 + (\alpha - 1) S_m} \tag{3.5}$$

where parameter $\alpha$ refers to total demand elasticity with respect to the level of aggregate service of all modes. As mentioned in subsection 2.2, the calculation of elasticities is based on observed market shares ($S_m$) rather than calculated shares. Equation (3.5) shows that the modal substitution index varies from one model to another only if the parameter $\alpha$ changes.

It is possible to estimate the parameter $\alpha$ from the PERAM, SLAG, Gaudry-Wills, HORIZONS and Peat-Marwick models. To calculate the price elasticities of total demand and the modal substitution indices using the probability models, a value must be assumed for the parameter α. For reasons discussed in subsection 3.3, the value assigned to the parameter α for the Ridout-Miller and Grayson models is the same as the value estimated by the Peat-Marwick model. The Wilson et al. and Stopher-Prashker models use the same value of α as the PERAM model. Therefore, the following property is obtained:

$$\begin{array}{lll} \theta^{s}_{m}(\text{Peat-Marwick}) & = \theta^{s}_{m}(\text{Ridout-Miller}) & = \theta^{s}_{m}(\text{Grayson}) \\ \theta^{s}_{m}(\text{PERAM}) & = \theta^{s}_{m}(\text{Wilson et al.}) & = \theta^{s}_{m}(\text{Stopher-Prashker}) \end{array} \qquad \text{P.8}$$

## 3.2 PRESENTATION OF RESULTS

For each of the markets studied, a three-part table provides the price elasticities associated with each demand model. The first part of the table, part **a**, contains direct price elasticities, that is, the demand sensitivity of a particular mode with respect to its price. The second part of the table, part **b**, reports cross price elasticities, that is, the demand sensitivity of a particular mode with respect to the price of another mode. The third and final part of the table, part **c**, contains price elasticities of the total demand for travel (all modes combined) with respect to the price of each mode, as well as the modal substitution indices.

More specifically, price elasticities for the level of modal demand ($\eta^{m}$(mode)) are reported in columns 1, 2, 3 and 4 in part **a**. Thus, according to the Peat-Marwick model, the demand elasticity for travel by car, with respect to the cost of a trip by car for the representative market (see Table 3.1 **a**), is –1.37; the demand elasticity of air travel, with respect to the cost of a trip by air, is –5.44, etc. Columns 5, 6, 7 and 8 contain the price elasticities of the modal share ($\eta^{m}$ (share)). According to the Peat-Marwick model, the price elasticity of the share of trips by auto, with respect to the cost of a trip by auto, is –0.68; the elasticity of the share of trips by air, with respect to the price of a trip by air, is –5.31, etc.

One of the distinctive characteristics of the demand models examined in this study, with the exception of the HORIZONS model, is that cross price elasticities of modal demands are all equal (see property P.7). Thus, the Peat-Marwick model estimates the demand elasticity of travel by air, rail or bus with respect to the cost of a trip by auto to be 2.24 (see Table 3.1 **b**).

Also, according to this model, the demand elasticity of travel by auto, rail or bus with respect to the cost of a trip by air is 0.44. Cross elasticities of the HORIZONS model (in part **b**) are averages. Appendix 1 reports all the direct and cross elasticities for the HORIZONS model.

Modal demand price elasticities ($\eta^m$ (mode)) are equal to the sum of the price elasticities of the modal share ($\eta^m$ (share)) and total demand ($\eta$ (total)). Thus, for the Peat-Marwick model, direct and cross elasticities with respect to the cost of a trip by auto, –1.37 and 2.24 (Table 3.1 **a** and **b**, column 1), are equal to the sum of the direct or cross elasticities of modal share with respect to the cost of a trip by auto, –0.68 and 2.93 (Table 3.1 **a** and **b**, column 5), and the total demand elasticities in relation to the price of a trip by auto, –0.70 (Table 3.1 **c**, column 1).

Modal substitution indices for the representative market are shown in columns 5 to 8 of Table 3.1 **c**. Thus, for the Peat-Marwick model, the modal substitution index for buses is 0.75. In response to a drop in the cost of the bus mode, 75 percent of the increase in travellers taking the bus comes from a diversion or a reduction in demand for other modes of transport, and 25 percent of the increase in demand for the bus mode is induced demand.

### *Table 3.1*
### *REPRESENTATIVE MARKET (1976)*

**(a) Direct Price Elasticities**

| | Direct price elasticities of modes | | | | Direct price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | –1.37 | –5.44 | –2.88 | –2.76 | –0.68 | –5.31 | –2.85 | –2.73 |
| Ridout-Miller | –1.06 | –4.13 | –2.18 | –2.09 | –0.52 | –4.02 | –2.16 | –2.07 |
| Gaudry-Wills | –0.55 | –1.34 | –1.64 | –1.66 | –0.31 | –1.32 | –1.63 | –1.65 |
| PERAM | –0.40 | –1.49 | –1.45 | –1.46 | –0.17 | –1.44 | –1.43 | –1.44 |
| SLAG | –1.26 | –2.55 | –2.63 | –2.64 | –0.51 | –2.46 | –2.59 | –2.60 |
| Wilson et al. | –0.46 | –1.57 | –0.83 | –0.79 | –0.19 | –1.52 | –0.81 | –0.78 |
| HORIZONS | –1.90 | –1.98 | –0.97 | –0.73 | –0.50 | –1.86 | –0.93 | –0.71 |
| Grayson | –0.66 | –2.56 | –1.35 | –1.30 | –0.32 | –2.49 | –1.34 | –1.28 |
| Stopher-Prashker | –1.77 | –3.69 | –3.83 | –3.84 | –0.74 | –3.57 | –3.77 | –3.79 |

*Table 3.1 (cont'd)*

*REPRESENTATIVE MARKET (1976)*

**(b) Cross Price Elasticities**

| Models | Cross price elasticities of modes | | | | Cross price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| Peat-Marwick | 2.24 | 0.44 | 0.11 | 0.09 | 2.93 | 0.57 | 0.14 | 0.12 |
| Ridout-Miller | 1.67 | 0.32 | 0.08 | 0.07 | 2.22 | 0.44 | 0.11 | 0.09 |
| Gaudry-Wills | 1.08 | 0.12 | 0.07 | 0.06 | 1.33 | 0.14 | 0.08 | 0.07 |
| PERAM | 0.50 | 0.11 | 0.05 | 0.04 | 0.73 | 0.16 | 0.07 | 0.06 |
| SLAG | 1.46 | 0.18 | 0.09 | 0.08 | 2.21 | 0.27 | 0.13 | 0.12 |
| Wilson et al. | 0.57 | 0.11 | 0.03 | 0.02 | 0.84 | 0.16 | 0.04 | 0.04 |
| HORIZONS | 0.77 | 0.15 | −0.02 | −0.02 | 2.17 | 0.27 | 0.01 | 0.01 |
| Grayson | 1.04 | 0.20 | 0.05 | 0.04 | 1.38 | 0.27 | 0.07 | 0.06 |
| Stopher-Prashker | 2.18 | 0.26 | 0.13 | 0.12 | 3.21 | 0.39 | 0.19 | 0.17 |

**(c) Price Elasticities of Total Demand and Modal Substitution Indices**

| Models | Price elasticities of total demand | | | | Modal substitution indices ($\theta^S_m$) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| Peat-Marwick | −0.72 | −0.14 | −0.04 | −0.03 | 0.36 | 0.73 | 0.74 | 0.75 |
| Ridout-Miller | −0.55 | −0.11 | −0.03 | −0.02 | 0.36 | 0.73 | 0.74 | 0.75 |
| Gaudry-Wills | −0.25 | −0.03 | −0.02 | −0.01 | 0.45 | 0.80 | 0.81 | 0.81 |
| PERAM | −0.23 | −0.05 | −0.02 | −0.02 | 0.29 | 0.66 | 0.67 | 0.67 |
| SLAG | −0.75 | −0.09 | −0.04 | −0.04 | 0.27 | 0.64 | 0.65 | 0.65 |
| Wilson et al. | −0.27 | −0.05 | −0.01 | −0.01 | 0.29 | 0.66 | 0.67 | 0.67 |
| HORIZONS | −1.40 | −0.12 | −0.03 | −0.02 | 0.09 | 0.37 | 0.29 | 0.28 |
| Grayson | −0.34 | −0.07 | −0.02 | −0.01 | 0.36 | 0.73 | 0.74 | 0.75 |
| Stopher-Prashker | −1.03 | −0.12 | −0.06 | −0.05 | 0.29 | 0.66 | 0.67 | 0.67 |

## 3.3 REPRESENTATIVE MARKET

This elasticity analysis starts with a representative intercity travel market defined by the mean values of the Transport Canada sample for 1976, found in Table 2.1. After an analysis of the price elasticities of the nine econometric models, price elasticities are suggested for the representative market. A discussion on modal substitution completes this section.

*Analysis:* The following analysis is based on the price elasticities of modal shares and total demand. The first six comments (C.1 to C.6) deal with the price elasticities of modal shares in columns 5, 6, 7 and 8 of Table 3.1 a and b. These comments also apply to the price elasticities of modal demand.

C.1: Except for the auto mode, the share of a mode is more sensitive to variations in its own price than to variations in the prices of the other modes. In other words, direct elasticities are greater than cross elasticities (columns 6, 7 and 8 of Table 3.1 **a** and **b**).

C.2: The relative size of cross price elasticities is similar to the relative shares of the modes. Thus, the price of the auto mode, which has the largest market share (81 percent), influences the other modes of transport the most. The effect of the cost of the air, rail and bus modes decreases as their market shares decrease (columns 5 to 8 in Table 3.1 **b**).

The first two comments can be explained by the fact that the share of the auto mode is 81 percent, which results in a low direct elasticity of that mode (property P.1) and high cross elasticities with respect to the cost of the auto mode (property P.2). In fact, it is known that demand models are such that the dominant mode has a relatively low direct elasticity and fairly high cross elasticities with respect to the cost of the dominant mode. The opposite is true for modes with small market shares (high direct elasticities and low cross elasticities).

C.3: The elasticities of the SLAG model do not differ very much from those of the Peat-Marwick, Ridout-Miller and Stopher-Prashker models.

As becomes evident from the discussion of other markets, price elasticities of the Peat-Marwick, Ridout-Miller and Stopher-Prashker models are very similar. Interestingly enough, the two probability models (Ridout-Miller and Peat-Marwick) were both estimated using the multinomial logit model based on travel within the Windsor–Quebec City corridor. However, the data base for the Peat-Marwick model dates back to 1989 and that of the Ridout-Miller model to 1969. Twenty years later, travellers' sensitivity to price has not changed! This answers one of the questions raised in the introduction: Can models calibrated at different periods be compared? The results do seem transferable over time.

The Stopher-Prashker model is also a multinomial logit model and was estimated using a sample of trips between 22 pairs of U.S. cities in 1972. The similarities between this model and the other two are also interesting in that they confirm the transferability of results over time and even suggest that the results can be transferred over space.

C.4: The structure of the elasticities of the HORIZONS model differs from those obtained from other models.

Like the Peat-Marwick model, the HORIZONS model is calibrated using the 1989 VIA Rail data base. The Peat-Marwick model retains the general formulation of the multinomial logit model and presumes that a traveller selects a mode of transport on the basis of a simultaneous comparison of levels of service. The HORIZONS model, however, uses the nested logit and assumes that the selection process is sequential. A choice is first made between private and public modes of transport and then, if necessary, between air or ground travel. Finally, a traveller decides on the rail or bus mode. Since the samples used to calibrate the Peat-Marwick and HORIZONS models are more or less the same, any differences between the price elasticities of the HORIZONS model and those of the Peat-Marwick model may be attributed to the sequential choice hypothesis.

C.5 The PERAM, Gaudry-Wills, Wilson et al. and Grayson models yield similar results.

The Gaudry-Wills and PERAM aggregate demand models yield more or less the same elasticities. As before, the hypothesis of transferability of results over time is supported because the two models use different calibration periods, 1972 and 1976, respectively. Similarities between the results of these two models hold for the other markets studied. This is not surprising because both models use a similar data base and the same explanatory variables. The Gaudry-Wills model generalizes the PERAM model by applying the Box-Cox and Box-Tukey transformations to the explanatory variables.

C.6: Despite the similarities mentioned above, there are some significant differences in price elasticities. Direct price elasticities of the share of the air mode vary from –5.3 to –1.3; those of the rail and bus modes, from –2.8 to –0.8. The higher values were obtained from the Peat-Marwick, Ridout-Miller and SLAG models. Unlike direct elasticities, cross elasticities differ more for the auto mode than for the public modes.

The last comment can be explained by properties P.1 and P.2. The three determinants of price elasticities are: parameters, market share and price. Since the same data base is used, these elasticity variations from one model to another are attributable solely to the fact that each model has distinctive parameters. The effect of these parameters is more noticeable when the share effect is significant. This is the case for the air, rail and bus direct elasticities (Table 3.1 **a**, columns 6–9), and the cross elasticities with respect to the price of the auto mode (Table 3.1 **b**, column 6).

Surprisingly, the SLAG model has higher elasticities than the other two aggregate models. This cannot be due to the formulation of the SLAG model because it is similar to the formulation of the PERAM model. Therefore, the sample used to calibrate the model must be examined. The Gaudry-Wills and SLAG models are both estimated using a sample for 1972. However, the Gaudry-Wills model has 92 city-pairs, while the SLAG model has 94. Since the exact list of city-pairs in each sample is not available, it can only be conjectured that the additional two city-pairs are responsible for the higher elasticities. Therefore, the SLAG model is excluded in the discussion of other markets.

It is obvious that the capacity of a model to produce reliable estimates is reduced when it is applied to markets that differ too much from the markets used to calibrate the model. The Peat-Marwick, Ridout-Miller, HORIZONS, Grayson and Stopher-Prashker probability models, which have been calibrated with markets whose distances and prices are less than those of the representative market, yield elasticities that do not seem credible. In fact, since the price elasticities of these models are directly proportional to prices (see property P.4), these models are not applicable when the prices are "relatively high." In proposing elasticities for the representative market, we have excluded the Peat-Marwick, Ridout-Miller, HORIZONS, Grayson and Stopher-Prashker models.

C.7: There are two sets of total demand elasticities with respect to the prices of the modes of transport. The first set (Peat-Marwick, Ridout-Miller, SLAG, HORIZONS and Stopher-Prashker models) implies demands that are more elastic than the second set (Gaudry-Wills, PERAM, Wilson et al. and Grayson models). (See Table 3.1 **c**.)

C.8: All models indicate that total demand is influenced the most by the price of the auto mode. The next in order of importance is the price of the air mode, followed by the price of the rail mode. Total demand hardly varies in relation to the price of the bus mode (Table 3.1 **c**).

Since the Peat-Marwick and HORIZONS models are calibrated with a travel sample from the Windsor–Quebec City corridor, it is not surprising that the total travel demand obtained is more elastic than the total travel demand throughout Canada. Comment C.8 is a direct consequence of the share effect explained in subsection 3.1 (see property P.3).

*Values Selected:* Because the price elasticities of the Gaudry-Wills, PERAM, Wilson et al. and Grayson models are sufficiently homogeneous, elasticities based on the PERAM model shown in Table 3.2 constitute the "best judgement" values.

*Table 3.2*

*PRICE ELASTICITIES AND SUBSTITUTION INDICES SELECTED, REPRESENTATIVE MARKET (1976)*

**(a) Direct and Cross Price Elasticities**

| | Price elasticities of modes of transport | | | | Price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| Direct elasticities | –0.40 | –1.49 | –1.45 | –1.46 | –0.17 | –1.44 | –1.43 | –1.44 |
| Cross elasticities | 0.50 | 0.11 | 0.05 | 0.04 | 0.73 | 0.16 | 0.07 | 0.06 |

**(b) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Price elasticities of total demand | | | | Modal substitution indices ($\theta^S_m$) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| | –0.23 | –0.05 | –0.02 | –0.02 | 0.29 | 0.66 | 0.67 | 0.67 |

An examination of own elasticities reveals that the demand for travel by auto is clearly inelastic: the demand for travel by auto reacts less than proportionally to a price increase. Conversely, the demand for the air mode is moderately elastic. Since the rail and bus modes have small market shares — 5 and 4 percent, respectively — there is a greater spread in the estimates for the direct elasticities of these modes. Demand sensitivity of the rail and bus modes seems to lie between that of the two other modes but is more similar to the elasticity of the air mode than the elasticity of the auto mode.

*Substitution among Modes:* Cross elasticities with respect to the cost of the rail (0.05) and bus (0.04) modes are low. At first sight, these elasticities seem negligible and could suggest that there is no substitution among modes. However, it can be shown quite easily that this is not the case and that there is significant modal substitution. For example, consider the impact of a 50 percent increase in the cost of the rail mode on the demand for other modes of transport. Given that the direct elasticity of the demand for the rail mode is –1.45, the demand for travel by rail drops 72.5 percent (–1.45 × 50 percent), or a reduction of 4536 (6257 × 0.725) trips. Since the substitution index for the rail mode is 67 percent, this means that of these 4,536 trips, 1497 trips (4536 × 0.33) represent a reduction in total demand and 3039 trips (4536 × 0.67) use the other modes of transport. Thus, modal substitution is responsible for 67 percent of the adjustment in demand for the rail and 33 percent of the adjustment results from a decrease in the total number of trips.

A study of the air and bus modes leads to the same conclusion: following a change in price of a public mode of transport, 66 percent of the changes in demand for that public mode are offset by changes in the other modes (public or private).

If the price of the auto mode increases, then 29 percent of the decrease in the demand for the auto mode is offset by an increase in the number of travellers using public modes of transport. Even though the substitution effect is significant, it remains less than the substitution effects brought about by changes in the prices of public modes.

## 3.4 INDIVIDUAL MARKETS

Having made various observations on the representative market, the price elasticities for three specific markets are examined: Montreal–Ottawa, Montreal–Toronto and Toronto–Vancouver.

### 3.4.1 The Montreal–Ottawa Market

*Analysis:* The discussion on the effect of price on price elasticity of modal shares in section 3.1 is very relevant to the Montreal–Ottawa market. According to Table 3.3 **a**, **b** and **c**, the three categories of models, identified by properties P.4, P.5 and P.6, result in fairly different elasticities. Models whose price elasticity is directly proportional to the price (Peat-Marwick, Ridout-Miller, HORIZONS, Grayson, Stopher-Prashker) yield fairly low elasticities; models whose price elasticity is inversely proportional to the price (Gaudry-Wills, Wilson et al.) result in fairly high price elasticities. The PERAM model yields elasticities that lie between the first two because price elasticity does not change as the price changes.

It is known that, on average, the prices used to calibrate the Gaudry-Wills model correspond to the prices of the representative market. The prices of the Montreal–Ottawa market are therefore "extreme" values for the Gaudry-Wills model, because they are lower than those of the representative market. Since the Gaudry-Wills model generates elasticities that are inversely proportional to prices (see property P.6), it is not surprising that this model yields elasticities that are large in magnitude. The same reasoning applies to the PERAM and Wilson et al. models. Consequently, the Gaudry-Wills, PERAM and Wilson et al. models seem ill-equipped to assist in the analysis of the Montreal–Ottawa market, and the estimates from these models are not used in choosing proposed values.

*Values selected:* The Peat-Marwick, Ridout-Miller, HORIZONS, Grayson and Stopher-Prashker models yield fairly homogeneous direct price elasticities. As was the case with the representative market, differences in elasticities across models are larger for the mode with the smallest market share — the air mode. The estimates are, however, similar enough to permit the use of the Peat-Marwick model as the representative model. Elasticities from this model are reported in Table 3.4.

*Table 3.3*

## MONTREAL–OTTAWA MARKET (1976)

**(a) Direct Price Estimates**

| | Direct price elasticities of modes | | | | Direct price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | –0.17 | –2.12 | –0.65 | –0.54 | –0.08 | –2.11 | –0.64 | –0.52 |
| Ridout-Miller | –0.13 | –1.59 | –0.47 | –0.41 | –0.06 | –1.59 | –0.48 | –0.39 |
| Gaudry-Wills | –0.79 | –1.82 | –2.28 | –2.10 | –0.50 | –1.82 | –2.27 | –2.05 |
| PERAM | –0.41 | –1.59 | –1.46 | –1.35 | –0.18 | –1.58 | –1.44 | –1.28 |
| Wilson et al. | –0.47 | –5.12 | –1.57 | –1.33 | –0.20 | –5.10 | –1.55 | –1.27 |
| HORIZONS | –0.23 | –0.78 | –0.19 | –0.16 | –0.06 | –0.77 | –0.19 | –0.14 |
| Grayson | –0.08 | –0.99 | –0.30 | –0.26 | –0.04 | –0.99 | –0.30 | –0.25 |
| Stopher-Prashker | –0.21 | –1.43 | –0.86 | –0.77 | –0.09 | –1.42 | –0.85 | –0.73 |

**(b) Cross Price Elasticities**

| | Cross price elasticities of modes | | | | Cross price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | 0.26 | 0.02 | 0.02 | 0.07 | 0.34 | 0.03 | 0.03 | 0.09 |
| Ridout-Miller | 0.20 | 0.02 | 0.02 | 0.05 | 0.26 | 0.02 | 0.02 | 0.07 |
| Gaudry-Wills | 1.78 | 0.02 | 0.08 | 0.30 | 2.06 | 0.02 | 0.09 | 0.35 |
| PERAM | 0.49 | 0.01 | 0.04 | 0.15 | 0.72 | 0.02 | 0.06 | 0.22 |
| Wilson et al. | 0.56 | 0.04 | 0.04 | 0.15 | 0.83 | 0.06 | 0.06 | 0.21 |
| HORIZONS | 0.09 | 0.01 | 0.00 | 0.00 | 0.25 | 0.01 | 0.01 | 0.02 |
| Grayson | 0.12 | 0.01 | 0.01 | 0.03 | 0.16 | 0.01 | 0.01 | 0.04 |
| Stopher-Prashker | 0.26 | 0.01 | 0.02 | 0.08 | 0.38 | 0.02 | 0.04 | 0.12 |

**(c) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Elasticities of travel demand | | | | Modal substitution indices ($\theta^{s}_{m}$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | –0.09 | –0.01 | –0.01 | –0.02 | 0.37 | 0.75 | 0.75 | 0.72 |
| Ridout-Miller | –0.06 | –0.01 | –0.01 | –0.02 | 0.37 | 0.75 | 0.75 | 0.72 |
| Gaudry-Wills | –0.28 | 0.00 | –0.01 | –0.05 | 0.55 | 0.86 | 0.86 | 0.84 |
| PERAM | –0.23 | –0.01 | –0.02 | –0.07 | 0.29 | 0.68 | 0.67 | 0.65 |
| Wilson et al. | –0.27 | –0.02 | –0.02 | –0.07 | 0.29 | 0.68 | 0.67 | 0.65 |
| HORIZONS | –0.16 | –0.01 | –0.01 | –0.02 | 0.10 | 0.42 | 0.20 | 0.29 |
| Grayson | –0.04 | 0.00 | 0.00 | –0.01 | 0.37 | 0.75 | 0.75 | 0.72 |
| Stopher-Prashker | –0.12 | –0.01 | –0.01 | –0.04 | 0.29 | 0.68 | 0.67 | 0.65 |

*Table 3.4*

Price Elasticities and Substitution Indices Selected, Montreal–Ottawa Market (1976)

**(a) Direct and Cross Price Elasticities**

| | Price elasticities of modes of transport | | | | Price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| Direct elasticities | –0.17 | –2.12 | –0.65 | –0.54 | –0.08 | –2.11 | –0.64 | –0.52 |
| Cross elasticities | 0.26 | 0.02 | 0.02 | 0.07 | 0.34 | 0.03 | 0.03 | 0.09 |

**(b) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Price elasticities of total demand | | | | Modal substitution indices $(\theta_m^g)$ | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. auto | 2. air | 3. rail | 4. bus | 5. auto | 6. air | 7. rail | 8. bus |
| | –0.09 | –0.01 | –0.01 | –0.02 | 0.37 | 0.75 | 0.75 | 0.72 |

Unlike the representative market, the price elasticities of the rail and bus modes are inelastic for the Montreal–Ottawa market. All the ground modes have inelastic demand (less than or equal to –0.65). Only the air mode has an elastic demand.

*Substitution among Modes:* The substitution index for the auto mode (0.37) implies that 37 percent of the decrease in demand for the auto mode, due to an increase in the price of that mode, is added to the demand for the public modes. However, 63 percent of the decrease in demand for the auto mode is reflected in a decrease in total demand. Even if the effect of substituting public modes for the private mode is small, it nevertheless has a considerable influence on the modal shares of the public modes. In fact, the cross elasticity of the public modes compared to the cost of the auto mode is fairly high (0.26).

A change in the price of a public mode primarily affects market shares while having little effect on total demand. The modal substitution effect is 75 percent for the air and rail modes and 72 percent for the bus mode.

### 3.4.2 The Montreal-Toronto Market

*Analysis:* The ela[illegible]s of the Montreal–Toronto market are reported in Table 3.6 **a**, **b** and [illegible] the four markets examined, this market has the most homogeneous elasticities across models. The only systematic difference comes from the HORIZONS and Grayson models, which yield considerably lower estimates of the own elasticities of the rail and bus modes. Perhaps the hypothesized sequential selection process of the HORIZONS model is responsible for the low elasticities associated with the public modes of ground transportation.

*Values Selected:* The price elasticities in Table 3.5 correspond to those of the Ridout-Miller model. The price elasticities of the Montreal–Toronto market do not differ very much from those of the representative market: demand for the auto mode is inelastic (–0.49) and demand for the public modes is elastic.

*Table 3.5*

*PRICE ELASTICITIES SELECTED, MONTREAL–TORONTO MARKET (1976)*

**(a) Direct and Cross Elasticities**

| | **Price elasticities of modes of transport** | | | | **Price elasticities of modal shares** | | | |
|---|---|---|---|---|---|---|---|---|
| | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Direct elasticities | –0.49 | –2.26 | –1.12 | –1.03 | –0.35 | –2.07 | –1.06 | –1.00 |
| Cross elasticities | 0.39 | 0.46 | 0.14 | 0.03 | 0.51 | 0.61 | 0.18 | 0.04 |

**(b) Price Elasticities of Total Demand and Modal Substitution Indices**

| | **Price elasticities of total demand** | | | | **Modal substitution indices ($\theta_m^s$)** | | | |
|---|---|---|---|---|---|---|---|---|
| | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| | –0.13 | –0.15 | –0.05 | –0.01 | 0.56 | 0.70 | 0.72 | 0.75 |

*Substitution among Modes:* The hypothesis of no modal substitution can be rejected. A change in the price of one mode will definitely lead to adjustments to the distribution of travel. The proportions of the adjustments resulting from a modal substitution are: 56 percent for the auto mode, 70 percent for the air mode, 72 percent for the rail mode and 75 percent for the bus mode.

## *Table 3.6*

## *MONTREAL–TORONTO MARKET (1976)*

**(a) Direct Price Elasticities**

| | Direct price elasticities of modes | | | | Direct price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | –0.64 | –3.00 | –1.49 | –1.37 | –0.48 | –2.80 | –1.43 | –1.36 |
| Ridout-Miller | –0.49 | –2.26 | –1.12 | –1.03 | –0.35 | –2.07 | –1.06 | –1.00 |
| Gaudry-Wills | –1.02 | –1.31 | –1.70 | –1.95 | –0.86 | –1.26 | –1.67 | –1.94 |
| PERAM | –0.54 | –1.35 | –1.35 | –1.46 | –0.37 | –1.24 | –1.28 | –1.44 |
| Wilson et al. | –0.62 | –2.70 | –1.33 | –1.21 | –0.42 | –2.47 | –1.26 | –1.20 |
| HORIZONS | –0.69 | –1.16 | –0.56 | –0.33 | –0.35 | –0.99 | –0.51 | –0.32 |
| Grayson | –0.31 | –1.41 | –0.70 | –0.64 | –0.23 | –1.32 | –0.67 | –0.64 |
| Stopher-Prashker | –0.77 | –2.06 | –1.99 | –1.91 | –0.53 | –1.89 | –1.89 | –1.88 |

**(b) Cross Price Elasticities**

| | Cross price elasticities of modes | | | | Cross price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | 0.53 | 0.63 | 0.18 | 0.04 | 0.69 | 0.82 | 0.24 | 0.05 |
| Ridout-Miller | 0.39 | 0.46 | 0.14 | 0.03 | 0.51 | 0.61 | 0.18 | 0.04 |
| Gaudry-Wills | 1.08 | 0.32 | 0.24 | 0.07 | 1.24 | 0.37 | 0.28 | 0.08 |
| PERAM | 0.36 | 0.25 | 0.15 | 0.04 | 0.53 | 0.36 | 0.22 | 0.06 |
| Wilson et al. | 0.42 | 0.49 | 0.14 | 0.03 | 0.61 | 0.72 | 0.21 | 0.05 |
| HORIZONS | 0.18 | 0.15 | -0.01 | 0.00 | 0.51 | 0.32 | 0.05 | 0.01 |
| Grayson | 0.25 | 0.29 | 0.09 | 0.02 | 0.33 | 0.38 | 0.11 | 0.03 |
| Stopher-Prashker | 0.52 | 0.37 | 0.22 | 0.05 | 0.76 | 0.55 | 0.32 | 0.08 |

**(c) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Price elasticities of total demand | | | | Modal substitution indices ($\theta^{s}_{m}$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Peat-Marwick | –0.17 | –0.20 | –0.06 | –0.01 | 0.56 | 0.70 | 0.72 | 0.75 |
| Ridout-Miller | –0.13 | –0.15 | –0.05 | –0.01 | 0.56 | 0.70 | 0.72 | 0.75 |
| Gaudry-Wills | –0.17 | –0.05 | –0.04 | –0.01 | 0.73 | 0.84 | 0.85 | 0.86 |
| PERAM | –0.17 | –0.12 | –0.07 | –0.02 | 0.47 | 0.62 | 0.65 | 0.67 |
| Wilson et al. | –0.20 | –0.23 | –0.07 | –0.02 | 0.47 | 0.62 | 0.65 | 0.67 |
| HORIZONS | –0.33 | –0.17 | –0.06 | –0.01 | 0.18 | 0.34 | 0.32 | 0.22 |
| Grayson | –0.08 | –0.10 | –0.03 | –0.01 | 0.56 | 0.70 | 0.72 | 0.75 |
| Stopher-Prashker | –0.24 | –0.18 | –0.10 | –0.02 | 0.47 | 0.62 | 0.65 | 0.67 |

### 3.4.3 The Toronto–Vancouver Market

*Values Selected:* For the same reasons as those discussed in the analysis of the representative market, only the Gaudry-Wills, PERAM and Wilson et al. models can be applied to the analysis of the Toronto–Vancouver market. The elasticities of these models for the Toronto–Vancouver market are reported in Table 3.8 **a**, **b** and **c**. Table 3.7 summarizes the various estimates of price elasticities.

*Analysis:* Apart from the dominant mode (air mode), demand elasticities for travel are unitary or elastic. It is interesting to note that the direct elasticity of the air mode is –0.62 and closely resembles the direct elasticity of the auto mode in the other markets.

*Substitution among Modes:* Total demand for the Toronto–Vancouver market is more sensitive to the price of the air mode than to the price of the ground transportation modes. Given an increase in the price of the auto mode, 68 percent of the decrease in travel by that mode is transferred to increases in travellers using the other modes. An increase in the price of the air mode, however, implies that 83 percent of the decrease in demand for the air mode leads to a decrease in total demand. The market shares of the auto, bus and rail modes are affected by a change in the price of the air mode as shown by the cross elasticity of 1.45.

*Table 3.7*

*PRICE ELASTICITIES SELECTED, TORONTO–VANCOUVER MARKET (1976)*

**(a) Direct and Cross Price Elasticities**

| | Price elasticities of modes of transport | | | | Price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Direct elasticities | –0.89 | –0.62 | –1.42 | –1.49 | –0.89 | –0.15 | –1.39 | –1.49 |
| Cross elasticities | 0.01 | 0.98 | 0.08 | 0.01 | 0.01 | 1.45 | 0.11 | 0.01 |

**(b) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Price elasticities of total demand | | | | Modal substitution indices ($\theta^{s}_{m}$) | | | |
|---|---|---|---|---|---|---|---|---|
| | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| | –0.00 | –0.46 | –0.04 | –0.00 | 0.68 | 0.17 | 0.66 | 0.68 |

*Table 3.8*

*TORONTO-VANCOUVER MARKET (1976)*

**(a) Direct Price Elasticities**

| | Direct price elasticities of modes | | | | Direct price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Gaudry-Wills | -1.26 | -0.32 | -1.30 | -1.42 | -1.26 | -0.12 | -1.28 | -1.42 |
| PERAM | -0.89 | -0.62 | -1.42 | -1.49 | -0.89 | -0.15 | -1.39 | -1.49 |
| Wilson et al. | -1.02 | -0.44 | -0.68 | -0.62 | -1.02 | -0.11 | -0.66 | -0.61 |

**(b) Cross Price Elasticities**

| | Cross price elasticities of modes | | | | Cross price elasticities of modal shares | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Gaudry-Wills | 0.01 | 0.92 | 0.09 | 0.01 | 0.01 | 1.12 | 0.11 | 0.01 |
| PERAM | 0.01 | 0.98 | 0.08 | 0.01 | 0.01 | 1.45 | 0.11 | 0.01 |
| Wilson et al. | 0.01 | 0.56 | 0.02 | 0.00 | 0.01 | 1.03 | 0.05 | 0.01 |

**(c) Price Elasticities of Total Demand and Modal Substitution Indices**

| | Price elasticities of total demand | | | | Modal substitution indices ($\theta^S_m$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Models** | **1. auto** | **2. air** | **3. rail** | **4. bus** | **5. auto** | **6. air** | **7. rail** | **8. bus** |
| Gaudry-Wills | -0.00 | -0.20 | -0.02 | -0.00 | 0.82 | 0.31 | 0.81 | 0.82 |
| PERAM | -0.00 | -0.46 | -0.04 | -0.00 | 0.68 | 0.17 | 0.66 | 0.68 |
| Wilson et al. | -0.00 | -0.33 | -0.02 | -0.00 | 0.68 | 0.17 | 0.66 | 0.68 |

## 4. THE EFFECTS OF AGGREGATION ON THE CALCULATION OF ELASTICITIES AND ON ESTIMATES

This section deals primarily with the quality of the method of approximation described in Section 2. The subject is dealt with by examining two elements separately: the use of a representative individual and the use of observed market shares.

Section 2 showed that the aggregate direct price elasticity of the share of mode *m* associated with a probability model is represented by equations (4.1), (4.2) and (4.3).

$$\eta_{C^m_m}(\text{market}) = \Sigma_k \eta_{C^m_m}(k) \cdot f_k \qquad (4.1)$$

$$\eta_{C^m_m}(k) = \beta \cdot C_m(\text{k}) \cdot [1 - \text{prob}_m(k)] \qquad (4.2)$$

$$\text{prob}_m(k) = \frac{\exp\,[\beta \cdot C_m(k) + A_m(k)]}{\Sigma_l \exp\,[\beta \cdot C_l(k) + A_l(k)]} \qquad (4.3)$$

where

$\text{prob}_m(k)$ = the probability that individual *k* will choose mode *m*;

$\eta_{C^m_m}(k)$ = the elasticity of the probability that individual *k* will choose mode *m* with respect to the price of that mode;

$\eta_{C^m_m}$ (market) = the aggregate own price elasticity with the enumeration method;

$f_k$ = individual *k*'s weight in the population;

$C_{ijm}(k)$ = the price of mode m for individual *k*;

$A_{ijm}(k)$ = the level of service of mode *m* for individual *k*, level of service associated with factors other than price.

Aggregate elasticity is derived as a result of a weighted sum of the elasticities of individuals. Since sample data are not available, this method cannot be used. In this study, aggregate own price elasticity obtained for a probability model is calculated using the equation:

$$\eta_{C^m_m}(\text{approx.}) = \beta \cdot \overline{C_m} \cdot (1 - S_m) \qquad (4.4)$$

A comparison of equations (4.1) to (4.3) with equation (4.4) shows the two methods differ in two ways:

- the aggregate value of price elasticity with equation (4.4) requires a single price value ($\overline{C_m}$), while the aggregate price elasticity obtained with equation (4.1) requires all the prices in the sample;

- the $\eta^{m}_{\mathcal{C}_m}$ (market) price elasticity is obtained from the calculated probability for each individual, while $\eta^{m}_{\mathcal{C}_m}$ (approx.) is obtained from the market share ($S_m$).

The similarity between the elasticities obtained with the enumeration method (4.1) to (4.3) and the elasticities calculated with equation (4.4) is illustrated by the following empirical examples.

*Santiago:* The first example comes from a logit model applied to urban data for Santiago, Chile.[6] The first column in Table 4.1 shows the direct price elasticities associated with this model, using the aggregation method for individual elasticities ($\eta^{m}_{\mathcal{C}_m}$ (market)). The second column contains direct price elasticities ($\eta^{m}_{\mathcal{C}_m}$ (approx.)) for a representative individual based on equation (4.4). The third column contains the price elasticity calculated for a representative individual, but the share calculated for a representative individual replaces the observed share in equation (4.4), as follows:

$$\eta^{m}_{\mathcal{C}_m}(\text{repres.}) = \overline{\beta} \cdot C_m \cdot \left[ 1 - \frac{\exp\,(\beta \cdot \overline{C_m} + \overline{A_m})}{\Sigma_l \exp\,(\beta \cdot \overline{C_l} + \overline{A_l})} \right] \qquad (4.5)$$

An examination of Table 4.1 shows that the three methods yield very similar estimates. Furthermore, a comparison of columns 2 and 3 indicates that the use of market shares yields more precise estimates than the use of the calculated share of the representative individual according to equation (4.5). Although this is not a scientific justification, this example confirms that the approximation of aggregate elasticities ($\eta^{m}_{\mathcal{C}_m}$ (approx.)) yields reasonable estimates.

*Table 4.1*

DIRECT PRICE ELASTICITIES WITH THREE DIFFERENT METHODS, SANTIAGO, CHILE

| | **1. Weighted sum of individual elasticities ($\eta^{m}_{\mathcal{C}_m}$(market))** | **2. Elasticities of a representative individual, market share ($\eta^{m}_{\mathcal{C}_m}$(approx.))** | **3. Elasticities of a representative individual, calculated probability ($\eta^{m}_{\mathcal{C}_m}$(repres.))** |
|---|---|---|---|
| Mode 1 | −0.251 | −0.340 | −0.370 |
| Mode 2 | −0.064 | −0.087 | −0.075 |
| Mode 3 | −0.213 | −0.233 | −0.240 |
| Mode 4 | −0.015 | −0.047 | −0.015 |
| Mode 5 | −0.049 | −0.069 | −0.095 |
| Mode 6 | −0.154 | −0.184 | −0.193 |
| Mode 7 | −0.070 | −0.075 | −0.077 |
| Mode 8 | −0.169 | −0.182 | −0.189 |
| Mode 9 | −0.141 | −0.153 | −0.160 |

*Montreal–Toronto:* The second example comes from the Peat-Marwick model (1990). The first row in Table 4.2 presents the direct price elasticities of the probability that a low-income individual will choose a mode of transport for "business purposes" in the Montreal–Toronto market. The second row reports the same elasticity for high-income individuals. Rows 4 and 5 report the same information for non-business travellers. These elasticities apply to an individual with the same characteristics as those presented in Table II-11 of the Peat-Marwick study (1990).[7] Equation 4.2 is used to calculate direct price elasticities.

Row 3 in Table 4.2 presents price elasticities calculated using the approximation of aggregate elasticity ($\eta^{m}_{\mathcal{C}m}$ (approx.)). The elasticities in row 3 differ from those in the first two rows because the calculated probabilities are replaced with market shares.

A comparison of row 3 with rows 1 and 2 in Table 4.2 shows that use of the approximation approach yields reasonable elasticities that lie between the elasticities for high- and low-income individuals.

Similar to row 3, row 6 reports price elasticities calculated using the approximation of the aggregate elasticity ($\eta^{m}_{\mathcal{C}m}$ (approx.)). The only difference is that the prices are not those for business trips, but rather, average prices of the modes for "business and other" purposes. The aggregate price elasticities of the Peat-Marwick model for the Montreal–Toronto market are not known, but they must correspond to the mean of the values in rows 1, 2, 4 and 5. This is precisely what is found in line 6 — an approximation of aggregate price elasticities for the Montreal–Toronto market.

*Table 4.2*

*PRICE ELASTICITIES FOR THE MONTREAL–TORONTO MARKET (1987) WITH THE PEAT-MARWICK MODEL (1990)*

| | Direct elasticities | | | | Cross elasticities | | | |
|---|---|---|---|---|---|---|---|---|
| | **auto** | **air** | **rail** | **bus** | **auto** | **air** | **rail** | **bus** |
| Business purposes: | | | | | | | | |
| 1. low-inc. calculated prob. | −2.69 | −2.28 | −1.79 | −1.04 | 0.53 | 3.84 | 0.41 | 0.02 |
| 2. high-inc. calculated prob. | −3.09 | −0.49 | −2.12 | −1.06 | 0.13 | 5.63 | 0.08 | 0.00 |
| 3. market share | −2.90 | −0.98 | −2.05 | −1.06 | 0.29 | 5.11 | 0.15 | 0.00 |
| Other motives, non-group: | | | | | | | | |
| 4. low-inc. calculated prob. | −0.69 | −4.14 | −1.43 | −1.04 | 0.64 | 0.47 | 0.32 | 0.31 |
| 5. high-inc. calculated prob. | −0.74 | −3.24 | −1.50 | −1.20 | 0.59 | 1.37 | 0.26 | 0.15 |
| All motives: | | | | | | | | |
| 6. market share, bus. motives parameters | −1.42 | −2.69 | −1.46 | −0.99 | 0.70 | 2.11 | 0.32 | 0.05 |

**Note: Equation (4.2) is used for rows 1, 2, 4 and 5, while the approximation equation (4.4) is used for rows 3 and 6.**

# 5. FORMULATING PRICE ELASTICITIES AND THE MODAL SUBSTITUTION INDEX

The formulas used to calculate the modal substitution index and price elasticities are presented here.

## 5.1 DESCRIPTION OF DEMAND MODELS

Details on the derivation of the information in Tables 3.3 to 3.8 are discussed in this section. Since the interest is in the demand sensitivity to the cost of the modes of transport, only the specification of the price variable is explained using the probability or modal-split model. All other variables in the modal-split or probability model are grouped together in the $A_{ijm}$ variable.

The calibrated parameters of some of the models have to be adjusted in order to compare the price elasticities given in Section 3. This adjustment consists of changing the monetary units of the coefficients in order to obtain the "Canadian cent of 1976" unit. The probability and modal-split models define the level of utility ($V_m$) of mode $m$ as:

$$V_m = \beta C_m + A_m \tag{5.1}$$

Coefficient $\beta$ is interpreted as utility per monetary unit of variable $C_m$; if the calibration period is 1972, the following transformation is necessary:

$$\beta_{1976} = \beta_{1972} \bullet \mathrm{IPC}_{1972}/\mathrm{IPC}_{1976} \tag{5.2}$$

where $\mathrm{IPC}_{1972}$ and $\mathrm{IPC}_{1976}$ refer to the 1972 and 1976 consumer price indices, respectively. Table 5.1 provides the values of price indices and exchange rates used in the calculations.

*Table 5.1*
PRICE INDICES AND EXCHANGE RATES

| | 1969 | 1972 | 1976 | 1977 | 1984 |
|---|---|---|---|---|---|
| Consumer price indices | 39.2 | 42.6 | 60.6 | 65.1 | 120.7 |
| Exchange rate ($ CAN./$ U.S.) | 1.077 | 0.991 | 0.986 | 1.063 | 1.295 |

The following notation is used:

$S_{ijm}$ = modal share of mode $m$ in market $ij$

$T_{ij}$ = total number of trips in market $ij$

$C_{ijm}$ = price of mode $m$ in market $ij$

$\mathrm{IPC}_y$ = consumer price index for the year $y$

$\mathrm{TDC}_y$ = U.S.$ exchange rate for the year $y$

$\eta_{C_m}$ (total) = total demand elasticity with respect to the price of mode $m$

$\eta^m_{C_m}$ (share) = elasticity of the share of mode $m$ ($S_{ijm}$) with respect to the price of mode $m$ ($C_{ijm}$).

### 5.1.1 The Gaudry-Wills Model (1978)

The 1972 Transport Canada data base was used to calibrate the Gaudry-Wills model. The generation-distribution model is formulated using equation (5.3) and the modal-split model is given in equation (5.4).

$$T_{ij} = [24.46 + 0.8P_{ij}^{(\lambda_1)} + 0.0014L_{ij}^{(\lambda_2)} + 2.5\{\Sigma_l \exp[-1.82(C_{ijl} + 35.7)^{(\lambda_3)} + A_{ijl}]\}]^{(\lambda_4)\ 1} \qquad (5.3)$$

$$S_{ijm} = \frac{\exp[-1.82(C_{ijm} + 35.7)^{(\lambda_3)} + A_{ijm}]}{\Sigma_l \exp[-1.82(C_{ijl} + 3.57)^{(\lambda_3)} + A_{ijl}]} \qquad (5.4)$$

where:

$P_iS$= the product of the population of city *i* and the population of city *j*;

$L_{ij}$ = similarity of the linguistic composition of city *i* and city *j*;

$A_{ijm}$ = travel time, number of departures.

Equations (5.5), (5.6) and (5.7) were used to calculate the price elasticities of the Gaudry-Wills model. For $\lambda_1 = 0.2$, $\lambda_2 = 1.94$, $\lambda_3 = -0.24$, and $\lambda_4 = -0.17$,

$$\eta_{C_m}(\text{total}) = -1.82 \bullet 2.5 \bullet (C_{mk} + 35.7)^{(-0.24-1)} \bullet S_{ijm} \bullet U^{0.04} \bullet T_{ij}^{-0.17} \qquad (5.5)$$

$$\eta^{m}_{C_m}(\text{share}) = -1.82 \bullet (C_{ijm} + 35.7)^{(-0.24-1)} \bullet C_{ijm} \bullet (1 - S_{ijm}) \qquad (5.6)$$

$$\eta^{m}_{C_l}(\text{share}) = 1.82 \bullet (C_{ijl} + 35.7)^{(-0.24-1)} \bullet C_{ijl} \bullet S_{ijl} \qquad (5.7)$$

### 5.1.2 The Grayson Model (1981)

The 1977 National Travel Survey data base was used to calibrate the Grayson model. The sample consisted of 1,658 trips between 46 city-pairs, including New York, San Francisco and Los Angeles. Equation (5.8) describes the probability model.

$$S_{ijm} = \frac{\exp(-0.016C_{ijm} + A_{ijm})}{\Sigma_l \exp(-0.016C_{ijl} + A_{ijl})} \qquad (5.8)$$

where

$A_{ijl}$ = time in vehicle, access time, waiting time.

Equations (5.9), (5.10) and (5.11) were used to calculate the price elasticities of the Grayson model.

$$\eta_{C_m}(\text{total}) = 0.247[-0.016\ \text{IPC}_{77}/(100\ \text{IPC}_{76}\text{TDC}_{77})] \cdot S_{ijm} \cdot C_{ijm} \qquad (5.9)$$

$$\eta^{m}_{C_m}(\text{share}) = [-0.016\ \text{IPC}_{77}/(100\ \text{IPC}_{76}\text{TDC}_{77})] \cdot C_{ijm} \cdot (1 - S_{ijm}) \qquad (5.10)$$

$$\eta^{m}_{C_l}(\text{share}) = [0.0161 \cdot \text{IPC}_{77}/(100\ \text{IPC}_{76}\text{TDC}_{77})] \cdot C_{ijl} \cdot S_{ijl} \qquad (5.11)$$

### 5.1.3 The HORIZONS Model

The 1987 data base for the Windsor–Quebec City Corridor Survey was used to calibrate the HORIZONS model. Equation (5.12) shows the generation-distribution model.

$$T_{ij} = e^{-15.7-0.23I_o+2I_q} \cdot U^{0.65} \cdot (Y_iE_j)^{1.04} \qquad (5.12)$$

where

$I_o$ = a trip with an origin and destination in Ontario

$I_q$ = a trip with an origin and destination in Quebec

$E_j$ = employment in city $j$

Equations (5.13) to (5.16) are for the conditional choice probability models. Thus, $S_a$ refers to the probability that the auto mode is chosen. The alternative is to choose a public mode of transport $(1 - S_a)$. $S_p$ refers to the probability that the public air mode is selected, provided a public mode of transport is selected. The alternative is to select a ground transportation mode $(1 - S_p)$. $S_t$ and $S_b$ refer to the probabilities that the train or bus mode are selected, respectively, provided a public mode of ground transportation is selected.

$$S_a = \frac{\exp(\beta_{10} + \beta_{11}GC_a)}{\exp(\beta_{01} + \beta_{11}GC_a) + \exp(\beta_{12}GC'_a)} \quad (5.13)$$

$$S_p = \frac{\exp(\beta_{20} + \beta_{21}GC_p)}{\exp(\beta_{20} + \beta_{21}GC_p) + \exp(\beta_{22}GC'_p)} \quad (5.14)$$

$$S_t = \frac{\exp(\beta_{30} + \beta_{31}GC_t)}{\exp(\beta_{30} + \beta_{31}GC_t) + \exp(\beta_{32}GC_b)} \quad (5.15)$$

$$S_b = \frac{\exp(\beta_{32}GC_b)}{\exp(\beta_{30} + \beta_{31}GC_t) + \exp(\beta_{32}GC_b)} \quad (5.16)$$

$$S_{auto} = S_a, \qquad S_{air} = (1 - S_a) \cdot S_p \quad (5.17)$$

$$S_{train} = (1 - S_a) \cdot (1 - S_p) \cdot S_t \quad (5.18)$$

$$S_{bus} = (1 - S_a) \cdot (1 - S_p) \cdot S_b \quad (5.19)$$

$$GC_b = A_b + C_b/VOT_b, \qquad GC_t = A_t + C_t/VOT_t \quad (5.20)$$

$$GC_p = A_p + C_p/VOT_p, \qquad GC_a = A_a + C_a/VOT_a \quad (5.21)$$

$$GC'_p = \ln[\exp(\beta_{30} + \beta_{31}GC_t) + \exp(\beta_{32}GC_b)] \quad (5.22)$$

$$GC'_a = \ln[\exp(\beta_{20} + \beta_{21}GC_p) + \exp(\beta_{22}GC'_p)] \quad (5.23)$$

$$VOT_a = 28, \quad VOT_p = 65.7, \quad VOT_t = 27.8, \quad VOT_b = 18.2 \quad (5.24)$$

The price elasticites of the generation-distribution model (5.11) are derived using equations (5.25) to (5.28).

$$\eta(\text{total, auto}) = \beta_{11} \cdot S_a \cdot C_a/VOT_a \quad (5.25)$$

$$\eta(\text{total, air}) = \beta_{12} \cdot \beta_{21} \cdot S_p \cdot C_p/VOT_p \quad (5.26)$$

$$\eta(\text{total, train}) = \beta_{12} \cdot \beta_{22} \cdot \beta_{31} \cdot S_t \cdot C_t/VOT_t \tag{5.27}$$

$$\eta(\text{total, bus}) = \beta_{12} \cdot \beta_{22} \cdot \beta_{32} \cdot S_b \cdot C_b/VOT_b \tag{5.28}$$

The equations from Table 5.2 were used to calculate the direct and cross elasticities of the modal shares in Appendix 1. The reader should note that the nested logit model implies a specific structure of cross elasticities: elasticities of the public modes with respect to the cost of the auto mode are equal; elasticities of the public modes of ground transportation with respect to the cost of the air mode are equal.

*Table 5.2*

*Price Elasticities of Modal Shares in the HORIZONS Model*

| | Auto |
|---|---|
| Auto<br>Air<br>Train<br>Bus | $\beta_{11} \cdot (1 - S_a) \cdot C_a/VOT_a$<br>$-\beta_{11} \cdot S_a \cdot C_a/VOT_a$<br>$-\beta_{11} \cdot S_a \cdot C_a/VOT_a$<br>$-\beta_{11} \cdot S_a \cdot C_a/VOT_a$ |
| | Air |
| Auto<br>Air<br>Train<br>Bus | $-\beta_{12} \cdot (1 - S_a) \cdot \beta_{21} \cdot S_p \cdot C_p/VOT_p$<br>$[-\beta_{12} \cdot S_a \cdot \beta_{21} \cdot S_p + \beta_{21} \cdot (1 - S_p)] \cdot C_p/VOT_p$<br>$(-\beta_{12} \cdot S_a \cdot \beta_{21} \cdot S_p - \beta_{21} \cdot S_p) \cdot C_p/VOT_p$<br>$(-\beta_{12} \cdot S_a \cdot \beta_{21} \cdot S_p - \beta_{21} \cdot S_p) \cdot C_p/VOT_p$ |
| | Train |
| Auto<br>Air<br>Train<br>Bus | $-\beta_{12} \cdot (1 - S_a) \cdot \beta_{22} \cdot (1 - S_p) \cdot \beta_{31} \cdot S_t \cdot C_t/VOT_t$<br>$[-\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p) \cdot \beta_{31} \cdot S_t - \beta_{22} \cdot (1 - S_p) \cdot \beta_{31} \cdot S_t] \cdot C_t/VOT_t$<br>$[\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p)\beta_{31} \cdot S_t - \beta_{22} \cdot S_p \cdot S_t \cdot \beta_{31} + \beta_{31} \cdot (1 - S_t)] \cdot C_t/VOT_t$<br>$[\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p)\beta_{31} \cdot S_t - \beta_{22} \cdot S_p \cdot S_t \cdot \beta_{31} - \beta_{31} \cdot S_t] \cdot C_t/VOT_t$ |
| | Bus |
| Auto<br>Air<br>Train<br>Bus | $-\beta_{12} \cdot (1 - S_a) \cdot \beta_{22} \cdot (1 - S_p) \cdot \beta_{32} \cdot S_b \cdot C_b/VOT_b$<br>$[-\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p) \cdot \beta_{32} \cdot S_b - \beta_{22} \cdot (1 - S_p) \cdot \beta_{32} \cdot S_b] \cdot C_b/VOT_b$<br>$[\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p)\beta_{32} \cdot S_b + \beta_{22} \cdot S_p \cdot S_b \cdot \beta_{32} - \beta_{32} \cdot S_b] \cdot C_b/VOT_b$<br>$[\beta_{12} \cdot S_a \cdot \beta_{22} \cdot (1 - S_p)\beta_{32} \cdot S_b + \beta_{22} \cdot S_p \cdot S_b \cdot \beta_{32} + \beta_{32} \cdot (1 - S_b)] \cdot C_b/VOT_b$ |

### 5.1.4 The PERAM Model (1976)

The sample used to calibrate the PERAM Model consists of 16 city–pairs in the 1976 Transport Canada data base. The generation-distribution model is described by (5.29). Equation (5.30) provides the modal-split model.

$$T_{ij} = e^{4.12} P_{ij}^{0.76} Y_{ij}^{0.56} \bullet \left(\Sigma_l C_{ijl}^{\beta_{1l}} A_{ijl}\right)^{0.32} \qquad (5.29)$$

$$S_{ijm} = \frac{C_{ijm}^{\beta 1m} A_{ijm}}{\Sigma_l C_{ijl}^{\beta 1m} A_{ijl}} \qquad (5.30)$$

where

$A_{ijm}$ = time spent in vehicle, frequency.

The price elasticities of the generation-distribution model (5.29) are derived using equation (5.31). The modal-split model price elasticities are derived using equations (5.32) and (5.33).

$$\eta_{C_m}(\text{total}) = \beta_{1m} \bullet 0.32 \bullet S_{ijm} \qquad (5.31)$$

$$\eta^{T}_{C_m}(\text{share}) = \beta_{1m} \bullet (1 - S_{ijm}) \qquad (5.32)$$

$$\eta^{T}_{C_l}(\text{share}) = -\beta_{1l} \bullet S_{ijl} \qquad (5.33)$$

$\beta_{auto} = -0.9, \quad \beta_{air} = -1.6, \quad \beta_{train} = -1.5, \quad \beta_{bus} = -1.5$

### 5.1.5 The Peat-Marwick Model (1990)

The data base for the 1987 Windsor–Quebec City corridor travel survey was used to calibrate the Peat-Marwick model. Equation (5.34) presents the generation-distribution model, while equation (5.35) describes the probability model for business travel purposes.

$$T_{ij} = e^{-6} P_i E_j^{0.39} \left[\Sigma_l \exp(-0.0317 C_{ijl} + A_{ijl})\right]^{.247} \qquad (5.34)$$

$$S_{ijm} = \frac{\exp(-0.0317 C_{ijm} + A_{ijm})}{\Sigma_l \exp(-0.0317 C_{ijl} + A_{ijl})} \qquad (5.35)$$

where

$A_{ijm}$ = time spent in vehicle, access time, waiting time, frequency.

The price elasticities of the generation-distribution model are derived using equation (5.36), while the price elasticities of the probability model use equations (5.37) and (5.38).

$$\eta_{C_m}(\text{total}) = 0.247 \cdot -0.0317 \cdot [\text{IPC}_{87}/(\text{IPC}_{76} \cdot 100)] \cdot S_{ijm} \cdot C_{ijm} \tag{5.36}$$

$$\eta^{m}_{C_m}(\text{share}) = -0.0317 \cdot [\text{IPC}_{87}/(\text{IPC}_{76} \cdot 100)] \cdot (1 - S_{ijm}) \cdot C_{ijm} \tag{5.37}$$

$$\eta^{m}_{C_l}(\text{share}) = 0.0317 \cdot [\text{IPC}_{87}/(\text{IPC}_{76} \cdot 100)] \cdot S_{ijm} \cdot C_{ijm} \tag{5.38}$$

### 5.1.6 The Ridout-Miller Model (1989)

The data base for the 1969 Windsor–Quebec city corridor survey was used to calibrate the Ridout-Miller probability model. The auto mode is omitted and the parameters used are those for business purposes.

$$S_{ijm} = \frac{\exp(-0.035C_{ijm}/Y_i + A_{ijm})}{\sum_l \exp(-0.035C_{ijl}/Y_i + A_{ijl})} \tag{5.39}$$

where

$A_{ijm}$ = access distance, travel time, economic sectors.

The price elasticities of the probability model are derived from equations (5.40) and (5.42).

$$\eta_{C_m}(\text{total}) = [0.32 \cdot -0.035\ \text{IPC}_{69}/(100\ \text{IPC}_{76})](C_{ijm}/Y_i)S_{ijm} \tag{5.40}$$

$$\eta^{m}_{C_m}(\text{share}) = [-0.035\ \text{IPC}_{69}/(100\ \text{IPC}_{76})](C_{ijm}/Y_i)(1 - S_{ijm}) \tag{5.41}$$

$$\eta^{m}_{C_l}(\text{share}) = [-0.035\ \text{IPC}_{69}/(100\ \text{IPC}_{76})](C_{ijl}/Y_i)(-S_{ijm}) \tag{5.42}$$

### 5.1.7 The SLAG Model (1975)

The 1972 Canadian Transport Commission data base was used to calibrate this model. A more detailed description of the SLAG model can be found in Rea et al. (1977). The generation-distribution model is given in (5.43), and the modal-split model is described in (5.44)

$$T_{ij} = e^{4.12}P_{ij}^{0.492}L_{ij}^{0.52} \cdot \left(\sum_l C_{ijl}^{-2.72}A_{ijl}\right)^{0.339} \tag{5.43}$$

$$S_{ijm} = \frac{C_{ijm}^{-2.72}A_{ijm}}{\sum_l C_{ijl}^{-2.72}A_{ijl}} \tag{5.44}$$

where

$P_{ij}$ = the product of the population of city $i$ and the population of city $j$

$L_{ij}$ = similarity in the linguistic composition of cities *i* and *j*

$A_{ijm}$ = travel time, number of departures

The price elasticities of the generation-distribution model are derived using equation (5.45) and those in the probability model are derived from equations (5.46) and (5.47).

$$\eta_{C_m}(\text{total}) = 0.339 \cdot -2.72 \cdot S_{ijm} \tag{5.45}$$

$$\eta^{m}_{C_m}(\text{share}) = -2.72 \cdot (1 - S_{ijm}) \tag{5.46}$$

$$\eta^{m}_{C_l}(\text{share}) = 2.72 \cdot S_{ijl} \tag{5.47}$$

### 5.1.8 The Stopher-Prashker Model (1976)

The 1972 National Travel Survey data base was used to calibrate the Stopher-Prashker probability model. The sample consists of 2,085 trips between 22 city-pairs. The $\overline{C_m}$ values correspond to those of the representative market.

$$S_{ijm} = \frac{\exp\,(-3.957 \cdot (C_{ijm}/\overline{C}) + A_{ijm})}{\sum_l \exp\,(-3.957 \cdot C_{ijl}/\overline{C} + A_{ijl})} \tag{5.48}$$

where

$A_{ijm}$ = time spent in vehicle, access time, number of departures.

The price elasticities of the probability model are derived from equations (5.49) to (5.51).

$$\eta_{C_m}(\text{total}) = 0.247 \cdot (-3.957) \cdot S_{ijm} \cdot C_{ijm}/\overline{C} \tag{5.49}$$

$$\eta^{m}_{C_m}(\text{share}) = -3.957 \cdot (1 - S_{ijm}) \cdot C_{ijm}/\overline{C} \tag{5.50}$$

$$\eta^{m}_{C_l}(\text{share}) = 3.957 \cdot S_{ijl} \cdot C_{ijl}/\overline{C} \tag{5.51}$$

### 5.1.9 The Wilson et al. Model (1990)

The 1976 Canadian Travel Survey data base was used to calibrate the Wilson et al. model. The probability model is reported in equation (5.52).

$$S_{ijm} = \frac{\exp\left(-15.08C_{ijm}/\mathrm{DIST}_{ij} + A_{ijm}\right)}{\Sigma_l \exp\left(-15.08C_{ijm}/\mathrm{DIST}_{ij} + A_{ijm}\right)} \qquad (5.52)$$

where

$A_{ijm}$ = travel time, number of departures, income.

The price elasticities of the probability model are derived using equations (5.53) to (5.55).

$$\eta_{C_m}(\text{total}) = 0.32 \cdot [-15.08\ \mathrm{IPC}_{84}/(100\ \mathrm{IPC}_{76})](C_{ijm}/\mathrm{DIST}_{ijm})(1 - S_{ijm}) \qquad (5.53)$$

$$\eta^{m}_{C_m}(\text{share}) = [-15.08\ \mathrm{IPC}_{84}/(100\ \mathrm{IPC}_{76})](C_{ijm}/\mathrm{DIST}_{ijm})(1 - S_{ijm}) \qquad (5.54)$$

$$\eta^{m}_{C_l}(\text{share}) = (15.08\ \mathrm{IPC}_{84}/(100\ \mathrm{IPC}_{76})](C_{ijl}/\mathrm{DIST}_{ijl})S_{ijl} \qquad (5.55)$$

## 5.2 DERIVING THE MODAL SUBSTITUTION INDEX

The modal substitution index is derived as follows for the rail mode:

$$\Delta T_{\text{train}} / \Delta C_{\text{train}} = \Delta T_{\text{total}} / \Delta C_{\text{train}} - \Delta T_{\text{auto}} / \Delta C_{\text{train}} - \Delta T_{\text{air}} / \Delta C_{\text{train}} - \Delta T_{\text{bus}} / \Delta C_{\text{train}} \qquad (5.56)$$

where

$T_{\text{train}}$ = the number of trips taken by the rail mode.

After a few transformations, the proportion that affects trips taken by the other modes ($\theta^{S}_{\text{train}}$) can be determined, as can the effect on total demand for trips ($\theta^{T}_{\text{train}}$).

$$\Delta T_{\text{train}} / \Delta C_{\text{train}} = \Delta T_{\text{total}} / \Delta C_{\text{train}} - \Delta T_{\text{auto}} / \Delta C_{\text{train}} - \Delta T_{\text{air}} / \Delta C_{\text{train}} - \Delta T_{\text{bus}} / \Delta C_{\text{train}}$$

$$1 = \frac{\Delta T_{\text{total}} / \Delta C_{\text{train}}}{\Delta T_{\text{train}} / \Delta C_{\text{train}}} - \frac{\Delta T_{\text{auto}} / \Delta C_{\text{train}}}{\Delta T_{\text{train}} / \Delta C_{\text{train}}} - \frac{\Delta T_{\text{air}} / \Delta C_{\text{train}}}{\Delta T_{\text{train}} / \Delta C_{\text{train}}} - \frac{\Delta T_{\text{bus}} / \Delta C_{\text{train}}}{\Delta T_{\text{train}} / \Delta C_{\text{train}}}$$

$$1 = \frac{\Delta T_{\text{total}} / \Delta C_{\text{train}}}{\Delta T_{\text{train}} / \Delta C_{\text{train}}} + \frac{\Delta T_{\text{auto}} / \Delta C_{\text{train}}}{\left|\Delta T_{\text{train}} / \Delta C_{\text{train}}\right|} + \frac{\Delta T_{\text{air}} / \Delta C_{\text{train}}}{\left|\Delta T_{\text{train}} / \Delta C_{\text{train}}\right|} + \frac{\Delta T_{\text{bus}} / \Delta C_{\text{train}}}{\left|\Delta T_{\text{train}} / \Delta C_{\text{train}}\right|}$$

$$1 = \frac{\eta^{T}_{C_{\text{train}}}}{\eta^{\text{train}}_{C_{\text{train}}} S_{\text{train}}} + \frac{\eta^{\text{auto}}_{C_{\text{train}}} S_{\text{auto}}}{|\eta^{\text{train}}_{C_{\text{train}}}| S_{\text{train}}} + \frac{\eta^{\text{air}}_{C_{\text{train}}} S_{\text{air}}}{|\eta^{\text{train}}_{C_{\text{train}}}| S_{\text{train}}} + \frac{\eta^{\text{bus}}_{C_{\text{train}}} S_{\text{bus}}}{|\eta^{\text{train}}_{C_{\text{train}}}| S_{\text{train}}}$$

$$1 = \theta^{T}_{\text{train}} + \theta^{S}_{\text{train}} \tag{5.57}$$

where

$$\theta^{S}_{\text{train}} = \frac{\eta^{T}_{C_{\text{train}}}}{\eta^{\text{train}}_{C_{\text{train}}} S_{\text{train}}}$$

and

$$\theta^{T}_{\text{train}} = 1 - \frac{\eta^{T}_{C_{\text{train}}}}{\eta^{\text{train}}_{C_{\text{train}}} S_{\text{train}}}$$

With the exception of the HORIZONS model, the general form of price elasticities of the demand models presented in the preceding section are:

$$\eta_{C_m}(\text{total}) = \alpha\beta_{1m} S_m C_m \tag{5.58}$$

$$\eta^{m}_{C_m}(\text{share}) = \beta_{1m}(1 - S_m)C_m \tag{5.59}$$

$$\eta^{m}_{C_m}(\text{mode}) = \eta_{C_m}(\text{total}) + \eta^{m}_{C_m}(\text{share}) \tag{5.60}$$

When equations (5–58) to (5-60) are substituted in the definition of $\theta^{S}_{m}$, the following is obtained:

$$\theta^{S}_{m} = \frac{1 - S_m}{1 + (\alpha - 1)S_m}$$

## 6. MODELS EXCLUDED FROM THE ANALYSIS

The nine models used in the analysis of price elasticities in this study are not exhaustive. In fact, there are a considerable number of intercity passenger travel demand models,[8] and some judgement had to be used to arrive at the list of nine models.

One of the selection criteria was the applicability of the model to Canadian markets. Some demand models estimated using Canadian data were excluded from the analysis: Gillen and Oum (1983), Andrikopoulos and Brox (1990) and Abdelawabah (1990).

## 6.1 DESCRIPTION OF EXCLUDED MODELS

### 6.1.1 The Gillen-Oum Model (1983)

Gillen and Oum (1983) developed a demand system to explain the percentage of income spent on the three modes of public intercity travel and on goods and services other than transportation. Since the model was calibrated using Canadian time series data, it is not possible to analyze specific markets like those discussed in this study. However, the price elasticities derived from the Gillen-Oum model for 1976 are comparable to those of the representative market, as can be seen in Table 6.1.

*Table 6.1*

PRICE ELASTICITIES OF THE REPRESENTATIVE MARKET AND THE GILLEN–OUM MODEL

| | 1. air | 2. rail | 3. bus |
|---|---|---|---|
| Direct price elasticities of modal shares with the representative market (see Table 3.2) | −1.44 | −1.43 | −1.44 |
| Direct price elasticities of percentage of expenditures on modes in 1976, Gillen–Oum model | −1.15 | −1.55 | −1.45 |

### 6.1.2 The Andrikopoulos-Brox Model (1990)

The Andrikopoulos-Brox model (1990) is a demand system that yields the percentage of income spent on the four modes of intercity transport. The 1976 Transport Canada data base, which contains data on intercity trips between 86 city-pairs by the four modes of transport, was used to calibrate the Andrikopoulos-Brox model. This model was not excluded for methodological reasons but rather for empirical reasons. The cross elasticities of this model imply that the four modes of intercity transport are complementary. Complementarity between some modes is not unreasonable, but complementarity on an aggregate level for all markets seems to run counter to intuition and to the findings of all recognized studies.

In addition to these empirical considerations, the Gillen-Oum and Andrikopoulos-Brox models both have, in our opinion, a methodological difficulty. They both produce price elasticity estimates for modal expenditures that are obtained from a calibration based on expenditure percentages. With the chain derivative technique, as in equation (6.1), the price elasticity of mode $m$ ($\eta^{m}_{C_m}$ (mode)) can be obtained by using the share of mode $m$ in total expenditures ($d_m$).

$$\eta^{\mathcal{T}}_{\mathcal{C}_m}(\text{mode}) = \frac{\partial T_m}{\partial C_m} \bullet \frac{C_m}{T_m}$$

$$= \frac{\partial T_m}{\partial d_m} \bullet \frac{\partial d_m}{\partial C_m} \bullet \frac{C_m}{T_m} \qquad (6.1)$$

where

$d_m$ = expenditure share of mode *m*.

$$d_m = \frac{C_m \bullet T_m}{\Sigma_l C_l \bullet T_l} \qquad (6.2)$$

since the number of trips taken by mode *m* is equal to the product of the total number of trips and the percentage of trips taken by mode *m*, when $\eta^{\mathcal{T}}_{\mathcal{C}_m}$ (mode) is calculated using (6.1), a price elasticity estimate of total demand is implicitly hidden. It is felt that the price elasticity of total demand should be obtained from a model that deals directly with total demand and not from a model that explains expenditure shares.

### 6.1.3 The Abdelawabah Model (1990)

The Abdelawabah model was omitted due to specification problems. In fact, this model does not include a price variable for business travel, because it did not have the "right" sign, that is, an increase in the price of a mode causes an increase in the probability that the mode is chosen.

## 7. CONCLUSION

Several intercity passenger travel demand models have been calibrated in the past. Price elasticities of travel demand obtained from these models are difficult to compare because they are usually calculated using different prices and different trips. This study compared, for the first time, price elasticities from different models.

Price elasticities (direct and cross) of demand for modes of transport within four Canadian markets were compared using the parameters from nine econometric models. The four Canadian markets are Montreal–Ottawa, Montreal–Toronto, Toronto–Vancouver and a representative market made up of 155 Canadian markets.

For each of the four markets analyzed, it was possible to propose price elasticities based on certain econometric models. Depending on the market studied, some models had to be disregarded. For example, the models estimated using information from the Windsor–Quebec City corridor cannot be applied to the study of travel in the Toronto–Vancouver market.

Direct elasticities for the rail and bus modes are practically identical for all markets. They are both inelastic (about –0.6) for the Montreal–Ottawa market and elastic (about –1.3) for the other markets. The demand for the auto mode almost has unit elasticity (about –0.9) for the "long distance" Toronto–Vancouver market and is inelastic (about –0.3) for the other markets. Unlike the auto mode, the demand for the air mode is inelastic for the Toronto–Vancouver market (about –0.6) and elastic for the other markets.

It was noted that, in general, modal substitution is very important. In fact, a change in the price of one mode of transport leads to substitution among the modes that is greater than the change in the total travel demand.

# APPENDIX 1. MODAL SHARES/ELASTICITIES FOR THE HORIZONS MODEL

*Table A1*

*PRICE ELASTICITIES OF THE HORIZONS MODEL*

| Representative Market | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Modal demand elasticities | | | | Modal share elasticities | | | |
| | Auto | Air | Rail | Bus | Auto | Air | Rail | Bus |
| Auto share | −1.90 | 0.07 | 0.02 | 0.01 | −0.50 | 0.19 | 0.05 | 0.04 |
| Air share | 0.77 | −1.98 | 0.05 | 0.04 | 2.17 | −1.86 | 0.08 | 0.06 |
| Rail share | 0.77 | 0.19 | −0.97 | −0.10 | 2.17 | 0.31 | −0.93 | −0.08 |
| Bus share | 0.77 | 0.19 | −0.14 | −0.73 | 2.17 | 0.31 | −0.11 | −0.71 |
| Total demand | −1.40 | −0.12 | −0.03 | −0.02 | — | — | — | — |
| **Montreal–Ottawa Market** | | | | | | | | |
| | Modal demand elasticities | | | | Modal share elasticities | | | |
| | Auto | Air | Rail | Bus | Auto | Air | Rail | Bus |
| Auto share | −0.23 | 0.00 | 0.00 | 0.01 | −0.06 | 0.01 | 0.01 | 0.03 |
| Air share | 0.09 | −0.78 | 0.01 | 0.02 | 0.25 | −0.77 | 0.02 | 0.04 |
| Rail share | 0.09 | 0.01 | −0.19 | −0.02 | 0.25 | 0.01 | −0.19 | −0.01 |
| Bus share | 0.09 | 0.01 | −0.01 | −0.16 | 0.25 | 0.01 | 0.00 | −0.14 |
| Total demand | −0.16 | −0.01 | −0.01 | −0.02 | — | — | — | — |
| **Montreal–Toronto Market** | | | | | | | | |
| | Modal demand elasticities | | | | Modal share elasticities | | | |
| | Auto | Air | Rail | Bus | Auto | Air | Rail | Bus |
| Auto share | −0.69 | 0.10 | 0.03 | 0.01 | −0.35 | 0.27 | 0.09 | 0.02 |
| Air share | 0.18 | −1.16 | 0.06 | 0.01 | 0.51 | −0.99 | 0.11 | 0.02 |
| Rail share | 0.18 | 0.17 | −0.56 | −0.02 | 0.51 | 0.35 | −0.51 | −0.01 |
| Bus share | 0.18 | 0.17 | −0.11 | −0.33 | 0.51 | 0.35 | −0.05 | −0.32 |
| Total demand | −0.33 | −0.17 | −0.06 | −0.01 | — | — | — | — |
| **Toronto–Vancouver Market** | | | | | | | | |
| | Modal demand elasticities | | | | Modal share elasticities | | | |
| | Auto | Air | Rail | Bus | Auto | Air | Rail | Bus |
| Auto share | −7.79 | 1.22 | 0.07 | 0.01 | −7.73 | 3.46 | 0.20 | 0.02 |
| Air share | 0.03 | −2.65 | −0.09 | 0.01 | 0.09 | −0.41 | 0.22 | 0.02 |
| Rail share | 0.03 | 1.64 | −2.73 | −0.06 | −0.09 | 3.88 | −2.60 | −0.05 |
| Bus share | 0.03 | 1.64 | −0.70 | −1.47 | 0.09 | 3.88 | −0.57 | −1.46 |
| Total demand | −0.06 | −2.24 | −0.13 | −0.01 | — | — | — | — |

## ENDNOTES

1. The author would like to thank Marc Gaudry, Sophie Mahseredjian and John Sargent for their comments.

2. Equation (2.2) is the elasticity equation from the logit model with a linear utility function. This equation is only given as an example to explain the three pieces of information required. The elasticities of the models examined in the next section were not necessarily obtained from equation (2.2).

3. Since it is clear that all the price elasticities discussed in Section 3 are obtained from an approximation of the aggregate price elasticity, the adjective "approx." has been omitted to facilitate reading.

4. The discussion is not particular to the approximation of aggregate price elasticity described in Section 2. It also holds for the "true" aggregate price elasticity (equation (2.1)).

5. More precisely, price elasticities decrease in relation to price if the price is greater than $1.40.

6. This model was derived by modifying the model in column $0^1$ of Table 5 in Gaudry et al. (1992).

7. The elasticities in rows 1, 2, 4 and 5 are also calculated by Miller and Fan (1992) (see Table 4(b)). The reasons for differences in the elasticities reported by Miller and Fan and those reported here are not known.

8. Miller and Fan (1992) describe and discuss intercity passenger transportation demand models.

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## 21

# DIFFERENTIAL TAXATION OF CANADIAN AND U.S. PASSENGER TRANSPORTATION

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## 1. INTRODUCTION

The inter-modal and international competitiveness of the Canadian passenger transportation sector has become a topical, yet somewhat contentious, issue. Of particular interest is the effect of the Canadian tax system on this competitiveness, or lack thereof. The purpose of this study is to examine and compare quantitatively the impact of taxes on the inter-modal competitiveness of Canadian intercity passenger transportation (air, bus and rail) and the competitiveness with U.S. carriers.

To determine the impact of taxes on competitiveness, it is important to clarify exactly what is meant by the term "competitive." This study is specifically interested in cost competitiveness. Taxes may affect the ability of firms in the transportation sector to compete, both against alternative modes and with U.S. competitors, by altering the cost of providing transportation services. To the extent that taxes affect costs differentially among modes, or impose a greater cost burden on Canadian companies vis-à-vis their American counterparts, taxes affect cost competitiveness. This study uses a new methodology which enables it to quantify the impact of taxation on the cost of providing transportation services and to compare this impact across modes.

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Many taxes potentially affect the cost competitiveness of transportation companies, either directly or indirectly. Unfortunately, data limitations preclude the analysis of all of them.[1] This study includes the following federal and provincial taxes in the analysis: fuel taxes, business taxes (for example, federal and provincial corporate income taxes and provincial capital taxes) and payroll taxes (including UIC, CPP/QPP and various provincial health taxes). Note that the introduction of the GST has largely removed any federal taxes on business inputs that existed under the old Federal Sales Tax. Although provincial retail sales taxes still result in the taxation of some business inputs, these are ignored in this analysis due to lack of data.

The remainder of the study is organized as follows. Section 2 gives a heuristic description of the methodology. Sections 3 and 4 present and discuss the results of the quantitative analysis. This includes a comparison of the impact of taxes on costs across modes as well as a Canada–United States comparison. The study also includes three fairly extensive appendices. Appendix A presents the methodology in a more rigorous fashion than Section 2, while Appendices B and C present the Canadian and United States data used in the computations.

## 2. METHODOLOGY

A popular approach to the comparative analysis of the impact of taxation on business operations is to undertake a cash flow analysis of the following sort: specify an "average" or "standard" enterprise for each mode of transportation, compute the total taxes paid by the standard firm and express these as a percentage of total costs, gross revenues or perhaps some definition of profits. While this commonly used "accounting" approach is useful in identifying important differences in the tax treatment of various modes, it lacks strong economic underpinnings and does not address the key questions addressed in this study: How do taxes affect the cost of providing a unit of transportation services? How does this impact vary across transportation modes?

To answer these questions, a new methodology grounded more firmly in the fundamentals of elementary economic analysis than the more traditional cash flow or project analysis approach has been developed. Although the concepts are simple and straightforward, to the authors' knowledge the approach has not been used in other studies of the transportation sector or otherwise. An intuitive explanation of the methodology is also provided, relying on concepts from elementary price theory. A more rigorous representation is contained in Appendix A.

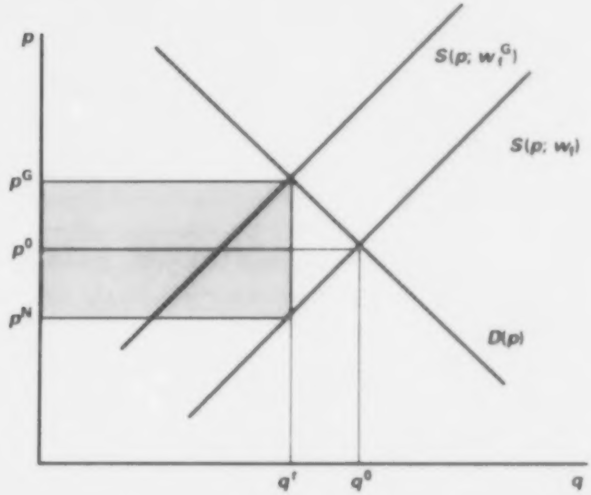
The idea is very simple. The study considers three broad inputs used in the production of transportation services: capital (buildings, land, machinery and equipment, and the "planes, trains and automobiles" themselves), labour and fuel. The cost of providing a unit of transportation services reflects the cost of purchasing these three inputs, which in turn may reflect various taxes levied on them, either directly or indirectly. Thus, although a tax is not levied directly on the cost of providing transportation services, the cost nevertheless reflects the imposition of taxes on the inputs used to produce the services. This study seeks to measure the "effective" rate of tax on the cost of providing the last, or marginal, unit of transportation services. This effective tax rate is simply the rate of tax which would have to be levied (hypothetically) directly on the marginal cost of providing transportation service to end up with the same gross-of-tax marginal cost which results from the various taxes actually levied on the firm's inputs. To the extent that the effective tax rate on the marginal cost of providing transportation differs across the three modes, the tax system affects the ability of these modes to compete both with each other and with their counterparts in the United States.

The methodology can best be illustrated by considering the example in Figure 1. As indicated above, the inputs used to produce transportation services are aggregated into three classes called capital, labour and fuel. The cost of purchasing a unit of each of these inputs is determined by the supply and demand conditions in the appropriate input market. Consider, for example, the cost of fuel. This study assumes that the producer price of fuel is fixed. This is equivalent to assuming that the supply curve for fuel is perfectly elastic. In the absence of taxes, the cost of a unit of fuel to the transportation sector is then simply equal to its fixed producer price, which is denoted by $w_f$.

Now consider the output market for transportation services provided by the bus industry, for example. The price of a unit of bus services is determined by the demand and supply conditions in that market. For the sake of expositional simplicity, it is assumed that the output market for bus services is characterized by perfect competition.[2] The price of a unit of bus transportation in the absence of any taxes is illustrated in Figure 1, where p is the

Figure 1

THE OUTPUT MARKET FOR TRANSPORTATION SERVICES



price, $D(p)$ is the aggregate demand curve for bus services and $(p; w_t)$ is the aggregate supply curve. (The reason for including $w_t$ in the supply function will be explained shortly.) The equilibrium price in the absence of any taxes is determined by the intersection of $D(p)$ and $S(p; w_t)$, and is denoted by $p^0$. (Ignore the rest of the diagram for the moment.)

How are the input and output markets connected? According to standard price theory, the aggregate supply curve for the output is simply the (horizontal) sum of the marginal cost curves for the individual suppliers. The marginal cost curves for these individual suppliers indicate the cost of providing an incremental unit of output at all output levels. Marginal costs are increasing over the relevant range of output (that is, the incremental cost of providing the tenth unit of output is greater than the cost of providing the first), thus the aggregate supply curve is upward sloping — more output is supplied at higher prices. The marginal cost of providing an additional unit of output for the individual suppliers obviously reflects the cost of the inputs used in production. This is why the aggregate supply function for transportation services is written as $(p; w_t)$ — to stress the fact that the function tells how much supply is forthcoming at various output prices given the price of the fuel input $w_f$. (Only the price of fuel is included in the function for simplicity. Obviously the prices of capital and labour could also be affected.) If input prices rise, the marginal cost of producing an additional unit of output will increase, and the aggregate supply curve will shift upward. This is the key link between the input and output markets which allows the determination of how taxes on business inputs affect the marginal cost of providing transportation services. If taxes cause the user cost of an input such as fuel to rise, the marginal cost to the firm of providing an additional unit of output will increase as well; by how much depends on the substitutability between inputs and the technology of how they are combined.

Given the expositional assumption that the output market is perfectly competitive, the equilibrium price of a unit of transportation services provided by bus companies is equal to the marginal cost of providing the last unit. Thus, $p^0 = \mathrm{MC}(q^0; w_f)$, where $\mathrm{MC}(q^0; w_f)$ is the marginal cost of providing the last unit of transportation services given that the price of fuel is $w_f$ and the total output produced is $q^0$.

Suppose a tax at the rate of $t$ percent is levied on the purchase of fuel. The impact of this tax on the cost of providing bus services can be illustrated in Figure 1. Given the assumption that the producer price of fuel is fixed at $w_f$, the user price increases from $w_f$ to $w_f^G$ where $w_f^G = w_f(1 + t)$. But the real interest is in the impact of the fuel tax on the cost of providing an incremental unit of bus transportation, rather than on the user cost of the fuel itself. This is where the relationship between the input and output markets discussed above is exploited.

As indicated earlier, the imposition of the fuel tax increases the user price of fuel to the bus industry from $w_f$ to $w_f^G$. This in turn increases the marginal cost of providing a unit of bus transportation. Thus, the marginal cost curves for the individual firms shift upward due to the fuel tax, which in turn causes the aggregate supply curve in Figure 1 to shift to $S(p; w_f^G)$, which is the supply curve for bus services given the now higher gross-of-tax input price for fuel, $w_f^G$. The increase in marginal costs, and therefore the upward shift in the aggregate output supply curve, leads to an increase in the equilibrium price of bus services from $p^0$ to $p^G$, where $p^G$ is the gross-of-fuel-tax price of a unit of bus transportation. Industry output falls to $q^t$.

Recall that given the expositional assumption of perfect competition in the output market, the output price is equal to the marginal cost of the last unit produced; therefore, $p^G = \mathrm{MC}(q^t; w_f^G)$, where $\mathrm{MC}(q^t; w_f^G)$ is the gross-of-fuel-tax marginal cost of providing the last unit of output expressed as a function of the user price of fuel $w_f^G$. Associated with the gross-of-tax marginal cost of a unit of transportation services is a net-of-tax marginal cost, defined as $p^N = \mathrm{MC}(q^t; w_f^G)$, where $w_f$ is the fixed supply price of a unit of fuel, as discussed above.

The effective tax rate on the marginal cost of providing bus services is defined as the rate of tax $T$ which if (hypothetically) directly applied to the marginal cost of bus transportation would yield the same gross-of-tax marginal cost that results under the fuel tax. Thus, $T$ solves the equation $(1 + T)\mathrm{MC}(q^t; w_f) = \mathrm{MC}(q^t; w_f^G)$, which gives $T = [\mathrm{MC}(q^t; w_f^G) - \mathrm{MC}(q^t; w_f)]/\mathrm{MC}(q^t; w_f)$.

The effective tax rate on the marginal cost of production gives the rate of tax on marginal costs implied by the various taxes levied on business inputs. For illustrative purposes, the study focussed on a simple fuel tax and its impact on the marginal cost of providing bus services; obviously other taxes apply both to fuel and to the other business inputs used in the bus, air and rail sectors. All of these taxes impinge on the marginal cost of transportation because they increase the user cost of the inputs. An effective tax rate on marginal costs, which reflects the aggregate imposition of all these taxes for each of the three modes, may be determined. In Section 3, estimates of $T$ for bus, air and rail for both Canada and the United States are presented.

The simplicity of the above discussion illustrates how straightforward the approach is, but it also masks a number of important empirical difficulties in actually measuring the effective tax rate on marginal costs. A few of the complications are mentioned here. A more extensive discussion is delegated to the data and methodological appendices.

The first complication concerns the marginal cost function. In order to estimate $T$, a specific functional form for the cost function must be selected. A number of choices are possible, including generalized functional forms, constant elasticity of substitution (CES), and Cobb-Douglas (C-D), which is a special case of the CES. In Section 3 estimates of $T$ using a constant returns to scale C-D cost function are presented. This has been used widely in other empirical work. For this parameterization, it turns out that $T$ is a simple function of the factor shares for capital, labour and fuel, and the effective rates of tax on those business inputs implied by the tax system. In Appendix A it is shown that for this functional form $T$ is determined as follows:

$$T = (1 + t_k)^{\alpha_k}(1 + t_f)^{\alpha_f}(1 + t_l)^{\alpha_l} - 1 \tag{1}$$

where $t_i$ is the effective tax rate on business input $i$, where $i$ = k,f,l for capital, labour and fuel respectively; $\alpha_k$ is the input share of capital, $\alpha_f$ is the share of fuel, and $\alpha_l$ is the share of labour, where $\sum_i \alpha_i = 1$ under the constant returns-to-scale assumption. $T$ is computed for each of bus, rail and air, where, of course, the input shares and the effective tax rates on the business inputs may vary by sector.

The simplicity of the expression for $T$ in the C-D case is misleading, as there are a number of empirical difficulties. The first concerns the determination of the effective tax rates on the business inputs themselves — the $t$ in the above expression. A number of issues arise. For example, a simple *ad valorem* fuel tax, such as discussed above, is straightforward; however, many provincial fuel taxes are levied on a specific, or per litre basis. Thus, it is necessary to convert these per litre taxes into *ad valorem* rates using data on average selling prices for fuel. This is a relatively simple problem to overcome; the other two inputs, labour and capital, give rise to more onerous difficulties.

In the case of capital, the federal and provincial income tax systems treat the capital used in the three sectors differently. For example, different capital cost allowance (CCA) rates apply to buses, planes and trains, and the allocation rules used to allocate taxable income among the provinces varies considerably for the three modes. Moreover, the "economic rate of depreciation" on the assets used in the three sectors differs. The effective tax rate on capital $t_c$ reflects all these differences, and others not mentioned here. There is also an aggregation problem which involves exactly what is meant by "capital." Different assets (machinery and equipment, buildings, land, etc.) bear different effective tax rates, and some degree of aggregation is required to determine the effective tax rate on the broad input called "capital."

In the case of labour, there are also difficulties in estimating $t_l$. Many of the payroll taxes levied on labour, for example, CPP/QPP and UIC, are imposed at a flat rate subject to an income threshold. Thus, the average payroll tax rate varies by the income of the workers. Moreover, payroll tax rates can vary according to the marital status of the individual. Since the interest in this study is on the impact of taxes on marginal costs — which is the cost of providing one more unit of output — the impact of taxes on the user cost of hiring the marginal worker must also be determined. But the effective tax rate on the marginal worker cannot be determined without knowing what the worker's income is! Thus, employment data for each mode are used to construct a profile of an "average" worker in each sector. See Appendix B for details.

Another concern is the treatment and interpretation of certain taxes that are related to government expenditures. Payroll taxes, property and fuel taxes can be considered "benefit taxes" in the sense that the payments are used to directly fund specific benefits, such as the provision of health care, municipal services and transportation infrastructures that are beneficial to the company.

A question arises regarding whether levies of this sort should be compared to other taxes less directly tied to the provision of benefits, such as general income taxes or sales taxes. There are two issues in this regard. First, although these benefit taxes certainly increase the marginal cost of providing transportation just as any other taxes do, it may be considered inappropriate to account for the costs associated with these taxes without at the same time somehow accounting for the benefits — for example, the availability of a healthier work force due to the provision of universal access to medical services — which may well lower costs. Second, in the absence of these benefit taxes, employers may fund things such as health insurance plans, sewage treatment and transportation infrastructures on their own, or in the case of payroll taxes, workers would have to bear some of the costs themselves which could lead to higher wages. In either case, the elimination of government services, and the taxes which fund them, may cause costs to actually increase. It is thus questionable that these benefit taxes actually impinge on the costs of providing output. On the other hand, the taxes may not be directly related to expenditure. For example, if a company hires one more worker and pays the payroll tax, services from the government are available irrespective of "insurance risks" of the worker (for example, there is no "experience related" social insurance).

A similar argument can be made with regard to fuel taxes that bear little relationship to the provision of road services. On the other hand, property taxes are directly related to the provision of municipal services to companies, especially development charges. Thus, effective tax rates on marginal costs for the case where payroll and fuel taxes impinge on costs are computed like any other tax. As well, given the data limitations discussed above and the difficulty in separating out the benefit portion of property taxes, they are not included in the calculations.

Finally, a comment should be made regarding the limitations of the approach adopted in this study. Although it goes considerably further than most studies of the impact of taxation on cost competitiveness by explicitly taking account of the linkages between the input and output markets and the technology which underlies it, this analysis is still partial equilibrium in nature. For example, producer prices are held at a fixed rate when determining the impact of taxes on the user costs of the inputs. Although this may be justifiable in a small open economy such as Canada, for some inputs, such as capital, for other inputs, in particular labour, this may be questionable. More generally, how taxes affect producer prices should be accounted for as well. This clearly would require a full general equilibrium analysis, which is beyond the scope of this study.

## 3. PRINCIPAL RESULTS OF THE COMPARISON OF CANADIAN MODES

The principal results of the analysis are shown in Tables 1 to 6, which contain estimates of the various effective tax rates ($t_k$, $t_l$, $t_f$, and $T$) for Canadian transportation companies.

Table 1 contains estimates of the effective tax rate on capital assets, $t_k$, both by category of asset and in aggregate. Capital assets in each mode are broken into five main categories: building construction, engineering construction, machinery and equipment, buses and capital items charged to expense accounts.[3] The calculations indicate that overall, capital investments in the rail industry are taxed at a slightly higher effective rate than bus and air (33.0%, 30.9% and 22.6% respectively). In aggregate, the Canadian tax system appears to favour capital investments in the air sector relative to bus and rail.

The differentials in marginal effective tax rates on capital primarily reflect differences in capital cost allowance (CCA) rates (unindexed for inflation) relative to "economic" rates of depreciation. For example, the CCA rate for air in the machinery and equipment category is 25%, two and a half times the estimate of 10% for the economic rate of depreciation for that category. The CCA rate in the same category for rail is 10%, almost equal to an economic depreciation rate of 8%, and the bus industry is allowed a CCA rate of 30%, only one and a half times the economic depreciation rate of 20%.[4] This can result in preferential treatment for air compared to rail and bus: as shown in Table 1, bus and rail face higher marginal effective tax rates on machinery and equipment.

*Table 1*

CANADIAN MARGINAL EFFECTIVE TAX RATES ON CAPITAL

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| **Parameterization** | | | |
| Percentage of debt in one dollar's worth of financing | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | 57 | 57 | 57 |
| Nominal return on debt | 12 | 12 | 12 |
| Nominal return on equity | 20 | 20 | 20 |
| Inflation rate | 5 | 5 | 5 |
| **Effective tax rate on capital** | | | |
| Building construction | 44.3 | 44.3 | 49.1 |
| Engineering construction | 29.6 | 44.3 | 29.8 |
| Machinery and equipment | 37.8 | na | 16.3 |
| Buses | na | 27.7 | na |
| Capital items charged to operating expenses | 2.3 | 2.3 | 2.3 |
| Overall ($t_k$) | 33.0 | 30.9 | 22.6 |

The aggregate effective tax rate on capital for each mode is the weighted average of the effective tax rates for the individual asset categories. If a mode exhibits a high marginal effective tax rate in a particular asset category, but the weight attached to that category is relatively low, the high marginal effective tax rate may be neutralized by the low capital expenditure weight. This point is illustrated in Table 1 where bus has the highest marginal effective tax rate in engineering construction (44.3% compared to 29.6% and 29.8% for rail and air respectively). However, the weight attached to engineering construction is only 1.1%, compared to 62.3% for rail.[5] Thus, the relative tax disadvantage for the bus industry in engineering construction is partially offset by the low expenditure weight in that category; the overall effective rate of tax on capital in the bus industry is still lower than the effective tax rate in the engineering construction category.

Tables 2 and 3 contain estimates of the marginal effective tax rate on labour, $t_l$, across modes. Table 2 gives the effective payroll tax rates for workers by income class. These rates are identical across modes since payroll taxes are uniform for all production sectors. In contrast, Table 3 presents effective payroll tax rates for an average worker in each sector, using a weighted average based on employment statistics to arrive at $t_l$ across modes. It turns out that the effective tax rates are very similar across modes (5.4%, 4.2% and 5.6% for rail, air and bus respectively). The differences are due solely to variations in the composition of the labour force across the modes.

*Table 2*
CANADIAN MARGINAL EFFECTIVE TAX RATES ON LABOUR BY INCOME CLASS
(ALL MODES)

| Income (CAN$) | (%) |
|---|---|
| 0–30,500 | 3.8 |
| 30,501–35,000 | 6.6 |
| 35,001–40,000 | 5.9 |
| 40,001–45,000 | 5.3 |
| 45,001–50,000 | 4.9 |
| 50,001–55,000 | 4.5 |
| 55,001–60,000 | 4.2 |
| 60,001–65,000 | 4.0 |
| 65,001–70,000 | 3.8 |
| 70,001–75,000 | 3.6 |
| 75,001–80,000 | 3.4 |
| 80,001– | 2.9 |

*Table 3*
CANADIAN MARGINAL EFFECTIVE TAX RATES ON LABOUR (%)
(WEIGHTED AVERAGE)

| Rail | Bus | Air |
|---|---|---|
| 5.41 | 4.18 | 5.61 |

Table 4 presents marginal effective tax rates on fuel, $t_f$, across modes for commercial and industrial fuel. The bus industry faces the largest $t_f$ for fuel: 63.6% versus 38.3% for rail and 32% for domestic air.[6] Since a lot of the flights that leave from Canadian airports have arrived from a different country, or are destined for a different country, Canadian planes load up with fuel in the country with the lower gross fuel costs. Since the United States is Canada's closest neighbour and since they also have very low fuel taxes relative to Canada, a combined weighted effective fuel tax rate that takes into account both the domestic and international aspects of Canadian airlines was calculated. Domestic rates are presumed to be the Canadian rates listed below. The United States effective tax rates on fuel were used to indicate rates faced by domestic airlines engaged in international flights. These effective rates were weighted by the proportion of aviation fuel consumed in Canada for domestic flights to aviation fuel consumed for international flights. For comparison, the effective fuel tax rate faced by Canadian airplanes that load up in the United States is also shown. Findings indicate that the combined Canadian and U.S. effective tax rate on fuel is 25.7%. This is lower than the rate given above for domestic flights only, but much higher than the U.S. counterpart (5.6%).

*Table 4*
*CANADIAN MARGINAL EFFECTIVE TAX RATES ON FUEL (%)*

| | | | Air | | |
|---|---|---|---|---|---|
| | **Rail** | **Bus** | **Domestic** | **U.S.** | **Combined** |
| Commercial and industrial | 38.3 | 63.3 | 32.0 | 5.6 | 25.7 |

While a comparison of the effective tax rates on each of the inputs used in the production of transportation services is certainly of some interest, an intermodal comparison of the impact of taxes on cost competitiveness requires going beyond a single dimensional analysis and examining how the various taxes on business inputs interact to affect the cost of providing an additional unit of output in the three sectors.

As discussed in the previous section, this is determined by calculating the effective rate of tax on the cost of providing an additional unit of transportation implied by the various taxes on the business input. Tables 5 and 6 present estimates of the effective tax rate on the marginal cost of production, $T$, across modes. The calculations are based on a constant returns to scale Cobb-Douglas (C-D) specification of costs which allows for the calculation of $T$ by weighting $t_i'$, $i$ = k,l,f, by each input's share of total costs. The shares are denoted as $\alpha_i$, for $i$ = k,l,f.

In Table 5 the effective tax rate on marginal costs reflects the following input shares for labour, fuel and capital: 41.1%, 8.6%, 50.3% in the rail industry; 27.4%, 18.1%, and 54.5% in the air industry; 42.5%, 8.4%, and 49.1% in the bus industry. (The shares are based on transportation statistics of the Royal Commission on National Passenger Transportation.)[7] For these input shares, the rail industry faces the highest effective tax rate on marginal costs at 21.3%, followed closely by both bus (21%) and air (19.3%). The effective tax rates are similar for all three modes, indicating that, on balance, the Canadian tax system does not appear to inhibit significantly cost competitiveness across modes. The relative tax disadvantages faced by the bus industry in terms of fuel are largely offset by low effective tax rates on labour and, to a lesser extent, capital.[8]

*Table 5*

*CANADA — EFFECTIVE TAX RATES ON MARGINAL COST AND MARGINAL EFFECTIVE TAX RATES ON INPUTS (REFERENCE INPUT SHARES)*

| | | Rail | Bus | Air |
|---|---|---|---|---|
| | | (%) | | |
| **Parameterization** | | | | |
| Percentage of debt in one dollar's worth of financing | ($\beta$) | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | ($1 - \beta$) | 57 | 57 | 57 |
| Nominal return on debt | ($i$) | 12 | 12 | 12 |
| Nominal return on equity | ($\rho$) | 20 | 20 | 20 |
| Inflation rate | ($\pi$) | 5 | 5 | 5 |
| **Input share** | | | | |
| Labour | ($\alpha_l$) | 41.1 | 42.5 | 27.4 |
| Fuel | ($\alpha_f$) | 8.6 | 8.4 | 18.1 |
| Capital | ($\alpha_k$) | 50.3 | 49.1 | 54.5 |
| **Marginal effective tax rate** | | | | |
| Labour | ($t_l$) | 5.4 | 4.2 | 5.6 |
| Fuel | ($t_f$) | 38.3 | 63.3 | 32.0 |
| Capital | ($t_k$) | 33.0 | 30.9 | 22.6 |
| Effective tax rate on marginal cost | ($T$) | 21.3 | 21.0 | 19.3 |

To isolate the implications of different share structures across modes for the impact of taxation on cost competitiveness, an alternative experiment was conducted where all of the other parameters were held constant and the input shares adjusted as follows. Gillen, Oum and Tretheway were used for air. They estimate that Air Canada's input share structure in 1980 was 30.2% for labour and 21.7% and 48.1% for fuel and capital respectively. Statistics Canada is used for rail. Their estimates of Canadian National's input shares for 1984 are 56%, 10% and 34% for labour, fuel and capital.

For the bus industry approximately the same shares are maintained (the largest change is in the share of fuel) as used above. The results of this experiment are summarized in Table 6.

*Table 6*
*CANADA — EFFECTIVE TAX RATES ON MARGINAL COST AND MARGINAL EFFECTIVE TAX RATES ON INPUTS (MODIFIED INPUT SHARES)*

| | | **Rail** | **Bus** | **Air** |
|---|---|---|---|---|
| | | (%) | | |
| **Parameterization** | | | | |
| Percentage of debt in one dollar's worth of financing | ($\beta$) | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | ($1 - \beta$) | 57 | 57 | 57 |
| Nominal return on debt | ($i$) | 12 | 12 | 12 |
| Nominal return on equity | ($\rho$) | 20 | 20 | 20 |
| Inflation rate | ($\pi$) | 5 | 5 | 5 |
| **Input share** | | | | |
| Labour | ($\alpha_l$) | 56 | 40 | 30 |
| Fuel | ($\alpha_f$) | 10 | 16 | 22 |
| Capital | ($\alpha_k$) | 34 | 44 | 48 |
| **Marginal effective tax rate** | | | | |
| Labour | ($t_l$) | 5.4 | 4.2 | 5.6 |
| Fuel | ($t_f$) | 38.3 | 63.3 | 32.0 |
| Capital | ($t_k$) | 33.0 | 30.9 | 22.6 |
| Effective tax rate on marginal cost | ($T$) | 17.2 | 23.8 | 19.2 |

From these figures it is clear that, under the modified share structure, the share of fuel input for the bus industry almost doubles (at the expense of both labour and capital). Given the high marginal effective tax rate on bus fuel, it is not unexpected that the bus industry assumes the position of the highest taxed mode. For the rail mode, the share of fuel is only marginally affected under the modified share structure. The share of labour (input with the lowest marginal effective tax rate) increases at the expense of capital (input with the highest marginal effective tax rate), resulting in rail being the least taxed mode. Under the modified share structure, the tax system seems to grant a competitive advantage to rail (17.2%) relative to bus (23.8%). The effective tax on marginal cost for the air mode remains at approximately 19%.

Finally, a second set of experiments uses U.S. and combined U.S.-Canadian effective tax rates on fuel in the air industry. These results are presented in Table 7. As is shown, the results suggest that employing a combined fuel tax rate of 25.7% in the air industry further adds to the tax advantage in that mode. Air now faces effective tax rates on marginal costs of 18.2% and 17.9% for the respective share structures. Furthermore, if Canadian planes are able always to load in the United States, the effective tax rate on marginal costs is even lower (14.6% and 13.5% for the respective share structures).

*Table 7*
CANADIAN AIR EFFECTIVE TAX RATES ON MARGINAL COST FOR THE SPECIFIED EFFECTIVE FUEL TAX RATES

| **Reference input shares** | | (%) |
|---|---|---|
| Labour | ($\alpha_l$) | 27.4 |
| Fuel | ($\alpha_f$) | 18.1 |
| Capital | ($\alpha_k$) | 54.5 |
| **Marginal effective tax rate** | | |
| Labour | ($t_l$) | 5.6 |
| Fuel (domestic) | ($t_f$) | 32.0 |
| Fuel (U.S.) | ($t_f$) | 5.6 |
| Fuel (combined) | ($t_f$) | 25.7 |
| Capital | ($t_k$) | 22.6 |
| Effective tax rate on marginal cost (domestic) | ($T$) | 19.3 |
| Effective tax rate on marginal cost (U.S.) | ($T$) | 14.6 |
| Effective tax rate on marginal cost (combined) | ($T$) | 18.2 |
| **Modified input share** | | |
| Labour | ($\alpha_l$) | 30 |
| Fuel | ($\alpha_f$) | 22 |
| Capital | ($\alpha_k$) | 48 |
| Effective tax rate on marginal cost (domestic) | ($T$) | 19.2 |
| Effective tax rate on marginal cost (U.S.) | ($T$) | 13.5 |
| Effective tax rate on marginal cost (combined) | ($T$) | 17.9 |

These calculations do not take into account the fact that some of the transportation companies may not be paying taxes in a particular year. As is well known, a company that experiences tax losses may be more or less highly taxed than full taxpaying companies. When a company is in a tax loss position, it is only able to carry back losses for three years or carry forward losses (at no interest) for seven years.[9] Thus, the time value of loss deductions, when carried forward, falls as it takes longer for the firm to use up losses.

The implication of tax losses is twofold. Companies with economic losses or fast write-offs for new investments cannot use the deductions immediately compared to companies that never carry forward losses. Thus, these companies, often facing risk, are more highly taxed than the taxpaying companies. On the other hand, profitable companies that are carrying forward prior years' losses, can shelter income earned from new investments until the company begins to pay taxes. In this case, the company can face a lower effective tax rate on investments compared to taxpaying companies. On balance, the degree to which losses affect the effective tax rate on capital cannot be judged unless more information is available on the time profile of taxable income and losses in the transportation industry.[10]

It is also important to emphasize the sensitivity of the results to changes in the parameters, particularly the input share structure. Though use of the reference input share structure indicates that the tax treatment across modes is equitable, the modified input shares place the bus industry at a competitive disadvantage relative to air and rail.

## 4. PRINCIPAL RESULTS OF CANADA–UNITED STATES COMPARISONS

In this section a similar analysis based on the American tax system is undertaken and the results are compared to the Canadian case. The principal results are contained in Tables 8 to 12.

Table 8 contains estimates of marginal effective tax rates on capital, $t_k$, both by category of asset and in aggregate. The results indicate that, in the United States, the rail industry faces the highest effective tax rate on capital (28.5%), followed by bus (25.1%) and air (19.5%). Like the Canadian case, the differences in effective tax rates on capital between modes are small and of the same ranking between modes. Capital investments in the rail industry are taxed at a relatively higher rate, while investments in airlines are taxed less overall by the American tax system because of generous tax depreciation rates for the air industry relative to the economic rate of depreciation. On balance, the American tax system favours capital investments in the air sector, followed by bus and then rail.

Overall, United States' carriers face slightly lower effective tax rates on capital than their Canadian counterparts. This is due in part to the capital cost recovery system in the United States. The write-offs for machinery and equipment in the United States are generally faster than those available to Canadian firms.[11] Another contributing factor is the lower statutory tax rate in the United States (on average across all states, 40.4% in the United States as opposed to a 42% to 43% federal and provincial combined rate in Canada).

*Table 8*

### U.S. MARGINAL EFFECTIVE TAX RATES ON CAPITAL

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| **Parameterization** | | | |
| Percentage of debt in one dollar's worth of financing | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | 57 | 57 | 57 |
| Nominal return on debt | 12 | 12 | 12 |
| Nominal return on equity | 20 | 20 | 20 |
| Inflation rate | 5 | 5 | 5 |
| **Effective tax rate on capital** | | | |
| Building construction | 37.5 | 37.5 | 41.6 |
| Engineering construction | 37.5 | 37.5 | 37.5 |
| Machinery and equipment | 9.2 | na | 14.2 |
| Buses | na | 22.1 | na |
| Capital items charged to operating expenses | -0.9 | -0.9 | -0.9 |
| Overall ($t_k$) | 28.5 | 25.1 | 19.5 |

Table 9 shows the estimates of the marginal effective tax rate on labour, $t_l$, for an average worker in each mode. As before, $t_l$ represents a weighted average based on labour statistics for each industry. The rates are very similar across modes (9.5%, 9.5% and 9.2% for rail, bus and air respectively). As in the Canadian case, the differences are due solely to variations in the composition of the labour force across modes. Overall, U.S. payroll tax rates are about 5 percentage points above the Canadian rates, so along this dimension, Canadian firms are at an advantage.

*Table 9*

### U.S. MARGINAL EFFECTIVE TAX RATES ON LABOUR (%)
(WEIGHTED AVERAGE)

| Rail | Bus | Air |
|---|---|---|
| 9.5 | 9.5 | 9.2 |

Table 10 presents marginal effective tax rates on fuel, $t_f$, across modes for retail fuel consumption. The bus industry has the highest effective tax rate on fuel: 44.7% versus 8.6% for rail and 5.6% for air. In comparison to Canada, the U.S. has a large fuel tax advantage in all three modes.[12] It should be noted that this comparison may be misleading since the differences in load factors and distances travelled by Canadian companies have not been taken into account. U.S firms face a denser and more multidimensional market when compared to their Canadian counterparts.

Table 10
U.S. MARGINAL EFFECTIVE TAX RATES ON FUEL (%)
(WEIGHTED)

| Rail | Bus | Air |
|---|---|---|
| 8.6 | 44.7 | 5.6 |

Tables 11 and 12 show estimates of the effective tax rate on the marginal cost of production, *T*, across modes for the United States. As in the Canadian case, *T* is calculated for a constant returns to scale Cobb-Douglas (C-D) specification of costs which allows *T* to be derived by weighting $t_i$, $i$ = k,l,f, by each input's share in total costs. The same input shares employed in the calculations for Canada were used. As the figures indicate, the air sector has a competitive advantage relative to bus and rail, while rail has a competitive advantage relative to bus. This reflects the preferential treatment of capital and fuel used in the air industry in the United States as well as the preferential treatment of fuel in the U.S. rail industry relative to bus.

In a mode-to-mode comparison with Canada, the calculations indicate that the effective rate of tax on marginal costs in the United States is lower for all modes. In the air industry, the U.S. rates are lower than those in Canada by approximately five percentage points (14.0% U.S. vs. 19.3% Canadian). This is due to a substantially lower fuel tax rate and a lower capital tax rate in the United States. Despite the significantly higher fuel tax rates in Canada for the rail and bus industry, the effective tax rates on marginal cost are quite competitive across countries. Due to the low share of fuel input in the rail and bus industries, large differences in the fuel taxes across countries have a small impact on the effective tax rates on marginal costs. Compared to their U.S. counterparts, Canadian modes have a tax advantage only in labour input.

As in the previous section, in order to isolate the implications of different input share structures across modes for the impact of U.S. taxation on the marginal cost of production, a sensitivity test is conducted with all the other parameters held constant. The input shares are adjusted accordingly. These alternative calculations are summarized in Table 12. Unlike the Canadian case, the ranking of the modes by their effective tax rates on marginal costs is not sensitive to the specified change in input share structures: under both share structure scenarios bus has the highest *T*, followed by rail and air.

Under the modified input share structure, the difference across countries in the effective tax rates on marginal costs lies within 2 percentage points for the rail and bus industries. For the air mode, the competitive edge of the United States has increased by 1 percentage point.

*Table 11*
*U.S. Effective Tax Rates on Marginal Cost and Marginal Effective Tax Rates on Inputs (Reference Input Shares)*

| | | Rail | Bus | Air |
|---|---|---|---|---|
| | | | (%) | |
| **Parameterization** | | | | |
| Percentage of debt in one dollar's worth of financing | ($\beta$) | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | ($1 - \beta$) | 57 | 57 | 57 |
| Nominal return on debt | ($i$) | 12 | 12 | 12 |
| Nominal return on equity | ($\rho$) | 20 | 20 | 20 |
| Inflation rate | ($\pi$) | 5 | 5 | 5 |
| **Input share** | | | | |
| Labour | ($\alpha_l$) | 41.1 | 42.5 | 27.4 |
| Fuel | ($\alpha_f$) | 8.6 | 8.4 | 18.1 |
| Capital | ($\alpha_k$) | 50.3 | 49.1 | 54.5 |
| **Marginal effective tax rate** | | | | |
| Labour | ($t_l$) | 9.5 | 9.5 | 9.2 |
| Fuel | ($t_f$) | 8.6 | 44.7 | 5.6 |
| Capital | ($t_k$) | 28.5 | 25.1 | 19.5 |
| Effective tax rate on marginal cost | ($T$) | 18.6 | 19.7 | 14.0 |

Overall, on balance (irrespective of the input share structure used) the Canadian tax system places transportation companies at a competitive disadvantage relative to their American counterparts, particularly for the air mode. Although the effective payroll tax rate is significantly lower in Canada, the effective rate of tax on fuel is substantially lower for all modes in the United States. The effective tax rates on capital are slightly lower for all U.S. modes.

*Table 12*

## U.S. EFFECTIVE TAX RATES ON MARGINAL COST AND MARGINAL EFFECTIVE TAX RATES ON INPUTS (MODIFIED INPUT SHARES)

| | | Rail | Bus | Air |
|---|---|---|---|---|
| | | (%) | | |
| **Parameterization** | | | | |
| Percentage of debt in one dollar's worth of financing | ($\beta$) | 43 | 43 | 43 |
| Percentage of equity in one dollar's worth of financing | ($1-\beta$) | 57 | 57 | 57 |
| Nominal return on debt | ($i$) | 12 | 12 | 12 |
| Nominal return on equity | ($\rho$) | 20 | 20 | 20 |
| Inflation rate | ($\pi$) | 5 | 5 | 5 |
| **Input share** | | | | |
| Labour | ($\alpha_l$) | 56 | 40 | 30 |
| Fuel | ($\alpha_f$) | 10 | 16 | 22 |
| Capital | ($\alpha_k$) | 34 | 44 | 48 |
| **Marginal effective tax rate** | | | | |
| Labour | ($t_l$) | 9.5 | 9.5 | 9.2 |
| Fuel | ($t_f$) | 8.6 | 44.7 | 5.6 |
| Capital | ($t_k$) | 28.5 | 25.1 | 19.5 |
| Effective tax rate on marginal cost | ($T$) | 15.5 | 21.4 | 13.2 |

# APPENDIX A: DERIVATION OF EFFECTIVE TAX RATES

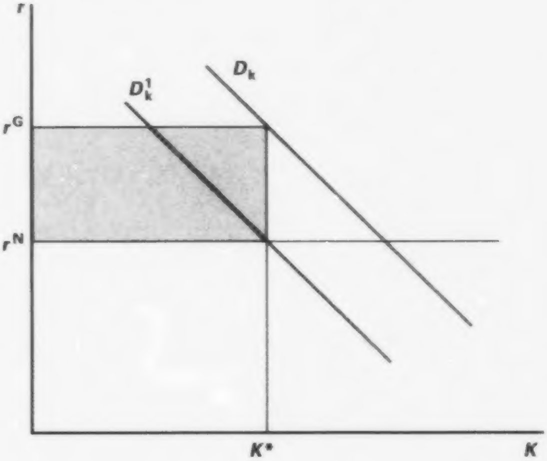
This appendix provi[illegible]ore formal statement of the methodology discussed in Section 2. First, the formulae are presented for marginal effective tax rates for three inputs in the production process: capital, labour and fuel ($t_k$, $t_l$ and $t_f$ respectively). Subsequently an expression for the effective tax rate on the marginal cost of production ($T$) is discussed.

## A.1 THE MARGINAL EFFECTIVE TAX RATE ON CAPITAL

The methodology closely follows Boadway, Bruce and Mintz (1987). It is assumed that the interest rate is invariant to changes in domestic fiscal policy. This is consistent with a small open economy assumption whereby the net-of-tax rate of return required by investors is determined by the world capital market. Figure 2 illustrates this situation diagrammatically. Domestic suppliers of capital must receive $r^N$, the net-of-tax world rate of interest, or else they would invest elsewhere. $D_k$ represents the demand for capital schedule, showing the relationship between the gross-of-tax rate of return and the quantity of capital demanded, $K$, while $D_k^1$ depicts the relationship between the net-of-tax rate of return to capital and the quantity of capital demanded. The intersection of $D_k^1$ and $r^N$ allows us to determine the equilibrium quantity of capital, $K^*$. Suppliers of capital will receive the net-of-tax real rate of return, $r^N$, while capital users will have to pay an amount equal to $r^G$. In turn, this will have to be equal to the marginal return to investment by a firm. The difference between $r^G$ and $r^N$ is a tax wedge created by tax instruments which affect the user cost of capital. This wedge, assumed to be net-of-depreciation and in real terms, may be converted to a rate by dividing it by the net-of-tax real rate of return paid to the supplier of capital. This rate is defined as $t_k$, the marginal effective tax rate on capital. In the following discussion expressions are determined for $r^N$ and $r^G$, and use $d$ to find $t_k = (r^G - r^N)/r^N$.

Before proceeding with the discussion, it is necessary to emphasize an important distinction concerning the economic nature of capital. Capital provides services over time and it depreciates, or physically wears out over time: capital services flow from the stock of capital while the stock itself depreciates. This distinction is crucial for the analysis of the effects of taxes on the user cost of capital since the tax code has an impact on the cost of capital services and the cost of depreciation through different channels:

*Figure 2*
THE MARKET FOR CAPITAL



capital services are affected by interest deductibility provisions in corporate income tax (CIT) rates at the federal and provincial level, while depreciation is affected by capital cost allowance (CCA) provisions.

When a cost-minimizing firm decides to make a marginal investment, neoclassical theory stipulates that the gross-of-tax return to that investment must be equal to what is termed the user cost of the investment in capital, which consists of two components: the user cost of financing capital services and the user cost of depreciation. Thus, the user cost of capital is affected both by taxes which directly affect the cost of financing and by tax provisions for depreciation. In the following the user cost of financing capital services and the user cost of depreciation are determined and then combined to arrive at an expression for the user cost of capital, $r^G$.

The user cost of financing capital services depends on the financial structure of the firm. A firm can choose to finance one dollar's worth of capital through debt financing — issuing bonds or borrowing funds — or through equity financing — retaining earnings or issuing new shares. The real cost of one dollar's worth of debt financing is the nominal interest rate adjusted for inflation, while the real cost of financing through equity is the nominal yield on equity adjusted for inflation and risk.

Corporate income taxes directly affect the real cost of debt financing through interest deductibility provisions, whereas the cost of equity is not deductible. In a small open economy the differential taxation of debt and equity at the personal level does not affect the cost of funds to the firm, and personal taxes may be ignored in what follows.

By defining the following terms:

$r^F$ = real gross-of-tax user cost of financing to the firm
$r^D$ = real gross-of-tax user cost of debt financing to the firm
$r^E$ = real gross-of-tax user cost of equity financing to the firm
$\beta$ = share of debt in one dollar's worth of financing capital services
$(1 - \beta)$ = share of equity in one dollar's worth of financing capital services
$i$ = nominal interest rate
$U^c$ = corporate income tax rates
$\rho$ = nominal return to equity
$\pi$ = inflation rate

the real gross-of-tax user cost of finance to the firm can be expressed as:

$$r^F = \beta r^D + (1 - \beta) r^E \tag{2}$$

where

$$r^D = i(1 - U^c) - \pi \tag{3}$$

and

$$r^E = \rho - \pi \tag{4}$$

Thus:

$$r^F = \beta i(1 - U^c) + (1 - \beta)\rho - \pi \tag{5}$$

As a corollary, note that the real rate of return required by the suppliers of capital, $r^N$, is simply $r^N = \beta i + (1 - \beta)\rho - \pi$. This expression provides the first term needed in order to calculate $t_k$.

The second component of the user cost of capital to the firm is the user cost of depreciation. As noted previously, capital stocks physically depreciate over time as they wear out. They may also appreciate or depreciate in value over time as a result of changes in the relative price of investment goods which differ from the inflation rate. The combination of these two characteristics of the capital stock is known as the economic rate of depreciation. Let $\dot{q}$ denote the real change in value of the capital stock and $\delta$ the physical rate of depreciation. The economic rate of depreciation is then $\delta^e = \delta - \dot{q}$ (the calculations in the text assume that $\dot{q} = 0$). Now suppose that CCAs are allowed at a constant declining-balance rate equal to $d$, ignoring for the moment the half-year rule in the Canadian tax code. The present value to the firm of capital cost allowances is then:

$$Z = \frac{U^c d}{r^F + \pi + d} \qquad (6)$$

In each period the CCA rate times the CIT rate is allowed as a deduction. If the fact that the value of the capital stock is reduced in each period by the CCA rate is taken into account and the fact that tax authorities base depreciation allowances on an historical cost basis, with no adjustment for inflation assumed, and if the CCA rates are discounted by the real cost of finance to the firm,[13] then the total gross-of-tax real cost of holding one dollar's worth of capital services may be defined as $(r^F + \delta^e)(1 - Z)$. At the margin, this real cost must equal the net-of-tax price the asset could be rented for in its next best use, and must be sufficient to cover economic depreciation as well as taxes. If $R^G(1 - U^c)$ is defined as the marginal net-of-tax return to capital, then the gross-of-tax return to capital is $R^G = (r^F + \delta^e)(1 - Z)/(1 - U^c)$. Since $R^G$ is gross-of-depreciation and the required net-of-depreciation return to the marginal investment is the desired calculation, the economic rate of depreciation must be subtracted from $R^G$ to arrive at $r^G$. The expression for $r^G$ may be summarized as follows:

$$r^G = (r^F + \delta^e)(1 - Z)/(1 - U^c) - \delta^e \qquad (7)$$

Now all the necessary information is in place to provide an expression for the marginal effective tax rate on capital, $t_k$. This rate may be formally expressed as follows:

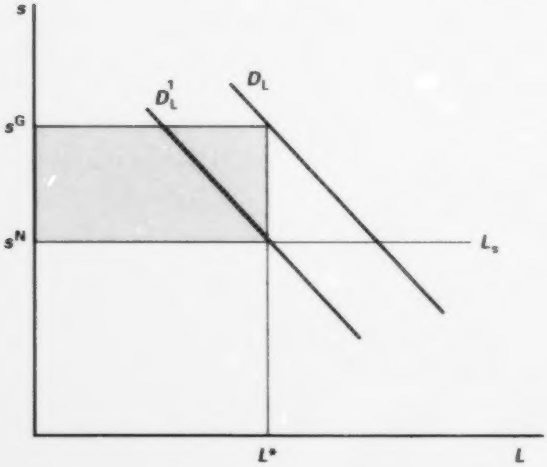
$$t_k = \frac{(r^F + \delta^e)(1 - Z)/(1 - U^c) - \delta^e - r^N}{r^N} \qquad (8)$$

## A.2 THE MARGINAL EFFECTIVE TAX RATE ON LABOUR

To calculate $t_l$ it must be assumed that for a particular sector, the elasticity of labour supply is infinite, that is, the supply curve, $L_s$, in Figure 3 is perfectly horizontal.[14] The gross-of-tax demand for labour curve in the transportation sector is downward sloping and is denoted as $D_L$ in Figure 3. $D_L$ depicts the relationship between labour demand and gross-of-tax wages, $s^G$. Since payroll taxes differ by type of worker (income level), the tax bill depends on the composition of the work force. For this analysis, this composition is assumed to be constant.

$D_L^1$ shows the relationship between net-of-tax wages, $s^N$, and labour demand. The difference between $s^G$ and $s^N$ is the tax wedge imposed on labour. Given the assumption of a perfectly elastic labour supply curve for a particular sector, and the inability to account properly for the possibility that payroll taxes may be interpreted as benefit taxes, the firm bears the entire burden of any taxes levied on their payroll.

*Figure 3*
THE MARKET FOR LABOUR



Given this interpretation, the marginal effective tax rate on labour is simply obtained as:

$$t_l = \frac{(s^G - s^N)}{s^N} \tag{9}$$

## A.3 THE MARGINAL EFFECTIVE TAX RATE ON FUEL

It is assumed that the single firm faces a horizontal supply curve for fuel. The marginal effective tax rates on fuel are then simply equal to the equivalent *ad valorem* statutory tax rates.

## A.4 THE EFFECTIVE TAX RATE ON MARGINAL COST

In this section the methodology to compute the effective tax rate on the marginal cost of production for given marginal effective tax rates on individual inputs is discussed, and some of the main methodological problems inherent in any cost study are mentioned.

Economic theory defines cost, $C(\mathbf{y}, \mathbf{w}')$, as the minimum value function for the following problem:

$$\min_{\mathbf{x}} \ \mathbf{w}'\mathbf{x} \ \ s.t. \ \ f(\mathbf{x}) = \mathbf{y} \tag{10}$$

where $\mathbf{y}$ is a vector of outputs, $\mathbf{x}$ is a vector of inputs, $f(\mathbf{x})$ is the representation of technology, and $\mathbf{w}'$ is the vector of factor input user prices. As such, $C(\mathbf{y}, \mathbf{w}')$ may be written as $C(\mathbf{y}, \mathbf{w}') = \mathbf{w}'\mathbf{x}^*$, where $\mathbf{x}^*$ represents optimal quantities of inputs and depends on the vector of outputs and the vector of user input prices. These user prices incorporate any opportunity costs associated with factor inputs. In general, $\mathbf{w}'$ will depend on market prices for inputs, $\mathbf{w}$, and a vector of marginal effective tax rates on inputs, $\mathbf{t}$.

In the absence of taxation, $\mathbf{w}' = \mathbf{w}$ and the incremental, or marginal, cost of producing an additional unit of output of type *i* is:

$$\mathrm{MC}_i(\mathbf{y}, \mathbf{w}) = \frac{\partial C(\mathbf{y}, \mathbf{w})}{\partial y_i} \tag{11}$$

When input taxes are introduced, $\mathbf{w}' = \mathbf{w}(1 + t)$. The marginal cost of producing an additional unit of output of type i is $MC_i[\mathbf{y}, \mathbf{w}(1 + t)]$.

The difference between $MC_i[\mathbf{y}, \mathbf{w}(1 + t)]$ and $MC_i(\mathbf{y}, \mathbf{w})$ may be thought of as the wedge between the gross-of-tax marginal cost and net-of-tax marginal cost for producing output of type *i*. The wedge depends on t and the functional form used to represent *C*. The wedge may be converted into a rate by dividing it by $MC_i(\mathbf{y}, \mathbf{w})$. This yields the marginal tax rate on marginal costs of production ($T$). $T$ serves as a tool for measuring the effective rate of tax on the marginal cost of providing transportation services. Modes in which a higher tax rate relative to other modes is observed are placed at a competitive disadvantage by the tax system.

The preceding remarks provide a very general description of the methodology adopted in this study. The next step is to discuss the treatment of costs in a more detailed fashion, first specifying the nature of carrier output and then examining functional forms which may be used for estimating $T$ across modes within a country or within modes across countries.

### Carrier Output

Passenger services differ according to service characteristics such as speed of trip, quality of service, etc.; this equates to a carrier providing different services or outputs on the same trip. In effect, multiple outputs are produced, the number of which depend on service definitions. It is beyond the scope of this paper to analyze multi-output passenger services. The assumption is made that each carrier produces a single homogeneous passenger output which is defined to be comparable across modes.

### Functional Forms

The analysis focusses on three types of inputs in the production process, capital, labour and fuel, and assumes that firms seek to combine these inputs in a way that will minimize the cost of attaining some level of output. The relationship between user prices and the cost of production is known as the cost function. The specific form of the cost function may be estimated econometrically using available data to recover the underlying structure of technology, and conclusions may be drawn regarding the specific parameters which describe an agent's behaviour. Since an econometric estimation is beyond the scope of this paper, the functional form to be used for representing costs is specified exogenously and parametric information is obtained from existing data and previous studies.

Informational requirements and restrictions faced in the study are discussed with three types of functional forms, the Cobb-Douglas (C-D) cost function and the constant elasticity of substitution cost function (of which the Cobb-Douglas is a special case). The informational requirements for the use of flexible functional forms are also discussed briefly.

### Cobb-Douglas Cost Function (C-D)

For inputs $i$ (i = capital (K), labour (L) and fuel (F)), the Cobb-Douglas cost function is written as:

$$C(y, \mathbf{w}') = Ay^{\frac{1}{\eta}} \prod_i (w_i')^{\alpha_i} \tag{12}$$

where $\sum_i \alpha_i = 1$, and $\eta$ represents the elasticity of scale. The underlying technology is homothetic and exhibits increasing, decreasing or constant returns-to-scale respectively for $\eta > 1$, $\eta < 1$ and $\eta = 1$. Allen-Uzawa elasticities of substitution ($\sigma_{ij} = C_{ij}C/C_iC_j$) are equal to unity for all pairs of factor inputs: this implies that value shares are constant for all inputs (they are represented by the $\alpha$ values).

The marginal cost of an additional unit of output is:

$$\mathrm{MC} = \frac{\partial C}{\partial y} = \frac{1}{\eta} Ay^{\frac{1-\eta}{\eta}} \prod_i (w_i')^{\alpha_i} \tag{13}$$

Given $N+1$ exogenous values for conditional demands and marginal cost, all $N+1$ free parameters can be recovered.

Then, $T$ can be obtained as follows:

$$T = \frac{\frac{1}{\eta} Ay^{\frac{1-\eta}{\eta}} \left[ \prod_i (w_i')^{\alpha_i} - \prod_i (w_i)^{\alpha_i} \right]}{\frac{1}{\eta} Ay^{\frac{1-\eta}{\eta}} \prod_i (w_i)^{\alpha_i}} \tag{14}$$

This can be simplified to:

$$T = \prod_i (1 + t_i)^{\alpha_i} - 1 \tag{15}$$

**Constant Elasticity of Substitution Cost Function (CES)**

The CES cost function is defined as follows:

$$C(y, \mathbf{w}') = Ay^{\frac{1}{\eta}}\left[\sum_i \alpha_i (w_i')^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{16}$$

where , $\sum_i \alpha_i = 1$, $\eta$ is the elasticity of scale, and $\sigma \neq 1$. The underlying technology is homothetic. Allen-Uzawa elasticities of substitution are equal to $\sigma$ for all pairs of factor inputs.

The following expression must be defined:

$$V(\mathbf{w}') = \left[\sum_i \alpha_i (w_i')^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{17}$$

(Notice that this expression is also valid for the Cobb-Douglas case when $\sigma = 1$ and $V(\mathbf{w}') = \prod_i (w_i')^{\alpha_i}$.)

The marginal cost of an additional unit of output is:

$$\mathrm{MC} = \frac{\partial C}{\partial y} = \frac{1}{\eta}\ Ay^{\frac{1-\eta}{\eta}} V(\mathbf{w}') \tag{18}$$

Given $N + 1$ exogenous values for conditional demands and marginal cost, and an exogenous estimate for $\sigma$, the residual $N + 1$ free parameters can be recovered.

Then, $T$ can be obtained as follows:

$$T = \frac{\frac{1}{\eta} Ay^{\frac{1-\eta}{\eta}} [V(\mathbf{w}') - V(\mathbf{w}')]}{\frac{1}{\eta} Ay^{\frac{1-\eta}{\eta}} V(\mathbf{w})} = \frac{\sum_i \alpha_i (w_i')^{1-\sigma}}{\sum_i \alpha_i (w_i)^{1-\sigma}} - 1 \tag{19}$$

### Flexible Functional Forms

Flexible functional forms allow for any regular configuration of Allen-Uzawa elasticities of substitution to be represented. Furthermore, they do not restrict the technology to be homothetic. Examples are the generalized Leontief cost function, the translog cost function and the non-separable CES function.

The informational requirements for using a flexible form are quite extensive: calibration requires exogenous values for all pair-wise elasticities of substitution as well as expenditure elasticities of input demand (for the non-homothetic case) and the elasticity of scale.

In this study, for the sake of simplicity, the single-output Cobb-Douglas technologies were adopted, and shares obtained from previous studies were used.

# APPENDIX B: STATUTORY TAX RATES AND AGGREGATION DATA

This appendix contains a summary of the taxes which were included in the analysis. Section B.1 discusses the tax provisions that have an impact on the user cost of capital: corporate income tax rates at the federal and provincial level that affect the user cost of financing capital services and capital cost allowances that affect the user cost of depreciation. Also included is a description of the weights that were used to aggregate depreciable capital assets and a summary of useful service lives of capital assets and their equivalent historical rates of depreciation. In sections B.2 and B.3 the taxes that affect labour and fuel respectively are discussed and presented in a tabular form.

## B.1 CAPITAL TAXES AND CAPITAL WEIGHTS

### B.1.1 Corporate Income Taxes

*Federal Corporate Income Tax Rate (FCIT):* The federal corporate income tax is levied on taxable income at a flat rate of 38 percent as of July 1, 1988.

*Federal Abatement:* All Canadian resident corporations, with the exception of federal Crown corporations,[15] are eligible for an abatement on federal tax payable to ease the burden of provincial corporate taxation. This abatement is equal to 10 percent of a corporation's taxable income earned in a province. The definition of taxable income earned in a province varies across modes of transportation as the Act treats transportation differently from other corporations. This aspect will be further analyzed when examining the effects of the CIT on the costs of financing capital for each mode.

*Federal Surtax:* As of 1987, a federal surtax of three percent is applied to federal tax payable. The 10 percent abatement is deducted from tax otherwise payable for the purpose of calculating the federal surtax, but the abatement is calculated on the whole of the corporation's taxable income earned in the year. All corporations with the exception of Crown corporations are eligible for the 10 percent reduction in the FCIT.

Table 13 exhibits the federal corporate income taxes for different business classifications. Transportation service industries are subject to the general business rate unless they qualify for the small business deduction; this analysis, however, precludes this possibility. The corporate rates presented are inclusive of the 10 percent reduction in the basic rate for provincial taxes paid.

*Table 13*

*FEDERAL CORPORATE INCOME TAXES, 1991*

| | Corporate rate | Surtax | Total rate |
|---|---|---|---|
| | (%) | | |
| **Effective July 1** | | | |
| General business | 28.00 | 3.00 | 28.84 |
| Manufacturing and processing | 23.00 | 3.00 | 23.84 |
| General small business | 12.00 | 3.00 | 12.84 |
| Small business manufacturing and processing | 12.00 | 3.00 | 12.84 |
| **For the calendar year** | | | |
| General business | 28.00 | 3.00 | 28.84 |
| Manufacturing and processing | 23.50 | 3.00 | 24.34 |
| General small business | 12.00 | 3.00 | 12.84 |
| Small business manufacturing and processing | 12.00 | 3.00 | 12.84 |

**Source: Canadian Tax Foundation publications.**

*Provincial Corporate Income Tax Rates:* Provinces in Canada may levy corporate taxes on corporations that are deemed to have a permanent establishment in their province. Table 14 presents a summary of provincial corporate income tax rates in effect as of 1991.[16] The federal government has an agreement with most provinces, whereby it collects provincial corporate income taxes for the province in exchange for the province's agreement to use the same tax base.[17] If a corporation has a permanent establishment in only one province, then that province applies its own tax rate to the total taxable income of the corporation. If a corporation has a permanent establishment in more than one province, then the taxable income attributable to a province is calculated according to an allocation rule.[18] For most corporations these allocation rules dictate that the proportion of taxable income attributable to a province is some average of the proportion of gross revenue earned in the province to total gross revenue earned in Canada, and the proportion of wages and salaries paid in the province to total wages and salaries paid in Canada. However, the *Income Tax Act* gives

*Table 14*

*PROVINCIAL CORPORATE INCOME TAX RATES, 1991*

| | Small | Large |
|---|---|---|
| **Province** | (%) | |
| Newfoundland | 0/10 | 17 |
| Prince Edward Island | 10 | 15 |
| Nova Scotia | 0/10 | 16 |
| New Brunswick | 5/9 | 17 |
| Quebec | 0/3.75 | 6.90/16.25 |
| Ontario | 0/10 | 14.5/15.5 |
| Manitoba | 10 | 17 |
| Saskatchewan | 0/10 | 15 |
| Alberta | 6 | 15.5 |
| British Columbia | 9 | 15 |
| Yukon | 2.5/5 | 2.5/10 |
| Northwest Territories | 5 | 12 |

**Sources: Canadian Tax Foundation publications and Arthur Andersen & Co., *Tax Forum*, Vol. 3, June 1991.**

**Note: Where two figures are shown, the first figure applies to businesses that qualify for preferential tax status.**

differential treatment to the transportation industry with respect to allocation rules: the allocation rule in each mode is unique. The rules for allocating taxable income to a province for rail, bus and air are as follows:

- Rail

Taxable income earned by a railway in a province in which it has a permanent establishment is defined as the taxable income of the railway times one half of the aggregate of the proportion of equated track miles[19] in a province equated to track miles in Canada; and, the proportion of gross tonne-miles in a province to gross tonne-miles of the corporation in Canada.[20]

- Bus

Taxable income earned by a bus corporation in a province in which it has a permanent establishment is defined as the taxable income of the bus corporation times one half of the aggregate of the proportion of the number of kilometres driven by the corporation's vehicles, whether owned or leased, in a province to the total number of kilometres driven in Canada; and, the proportion of the aggregate of salaries and wages paid in the province to the aggregate of all salaries and wages paid in Canada.[21]

- Air

Taxable income earned by an airline corporation in a province in which it had a permanent establishment is defined as the taxable income of the airline times one quarter of the aggregate of the proportion of the capital cost of the corporation's fixed assets, except aircraft, in a province, to the capital cost of the corporation's fixed assets, except aircraft, in Canada; and, the proportion of three times the number of revenue plane miles flown by its aircraft in a province to the total number of revenue plane miles flown in Canada by its aircraft.[22]

To summarize, tax instruments that affect the real cost of financing through debt are: the federal corporate income tax, the federal abatement for provincial taxation, the federal surtax, provincial corporate income taxes and the rules used for allocating taxable income to a province. To the extent that any of these differ among modes, the real cost of financing through debt will differ among modes. In turn, this will affect the real cost of finance across modes of transportation. Table 15 shows combined federal and provincial corporate income tax rates by province for small businesses and other types of establishments, while Table 16 depicts combined federal and provincial corporate income rates for rail, bus and air by province, inclusive of the

*Table 15*

*COMBINED FEDERAL AND PROVINCIAL CORPORATE INCOME TAX RATES BY PROVINCE, 1991*

| | **Small** | **Large** |
|---|---|---|
| **Province** | (%) | |
| Newfoundland | 22.84 | 45.84 |
| Prince Edward Island | 22.84 | 43.84 |
| Nova Scotia | 22.84 | 44.84 |
| New Brunswick | 21.84 | 45.84 |
| Quebec | 16.54 | 35.74 |
| Ontario | 22.84 | 44.34 |
| Manitoba | 22.84 | 45.84 |
| Saskatchewan | 22.84 | 43.84 |
| Alberta | 21.84 | 44.34 |
| British Columbia | 21.84 | 43.84 |
| Yukon | 17.84 | 38.84 |
| Northwest Territories | 17.84 | 40.84 |

**Sources: Canadian Tax Foundation publications and Arthur Andersen & Co., *Tax Forum*, Vol. 3, June 1991.**

**Note: Large transportation firms are taxed at the lower provincial rate for large businesses in Quebec.**

allocation rules used for calculating taxable income in a province. When all is said and done, it turns out that the combined rounded corporate income rates are very similar across the modes: bus has the lowest rate at 42% followed closely by air and rail at 43%.

*Table 16*

COMBINED FEDERAL AND PROVINCIAL CORPORATE INCOME TAX RATES BY PROVINCE, 1991

| Province | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Newfoundland | 0.18 | 0.09 | 0.05 |
| Prince Edward Island | 0.00 | 0.00 | 0.04 |
| Nova Scotia | 0.67 | 0.90 | 1.35 |
| New Brunswick | 1.24 | 2.29 | 1.83 |
| Quebec | 4.22 | 9.04 | 7.15 |
| Ontario | 15.34 | 17.87 | 16.85 |
| Manitoba | 3.94 | 1.19 | 1.83 |
| Saskatchewan | 5.00 | 0.75 | 1.75 |
| Alberta | 4.66 | 3.33 | 3.55 |
| British Columbia | 7.93 | 6.60 | 8.05 |
| **Total** | **43.00** | **42.00** | **43.00** |

### B.1.2 Capital Cost Allowances

Allowable capital costs may be deducted from taxable income for tax purposes. These deductions are specified by the *Income Tax Act* and are allowed on depreciable capital assets. For tax purposes, assets are grouped into different classes; these classes are then assigned a rate at which capital costs may be deducted from taxable income. A constant declining-balance rate is used for most classes of capital assets, although some classes receive straight-line treatment. The *Income Tax Act* dictates that the allowable CCA rate be applied to the original undepreciated cost of the asset, and in the first year of acquisition the allowable rate is one half of the rate applied to subsequent years.[23] In this section the data used to calculate the present value of CCA deductions are presented. In Table 17, classes of assets prescribed by the *Income Tax Act* and the associated, applicable CCA rate are shown. These classes are then aggregated into five categories of depreciable capital: building construction, engineering construction, machinery and equipment, and capital items charged to expense accounts. These categories and their associated CCA rates are presented by mode in Table 18.

*Table 17*
### CCA RATES BY CLASS OF ASSET

| | Class | Rate (%) |
|---|---|---|
| Airplane hangars | 6 | 10 |
| Aircraft — | | |
| furniture, fittings, equipment, or spare parts | 9 | 25 |
| Airplane runways | 1 | 4 |
| Asphalt surface, storage yard | 1 | 4 |
| Automobiles | 10 | 30 |
| Buildings — | | |
| brick, stone, cement, etc. acquired after 1987 | 1 | 4 |
| Buses | 10 | 30 |
| Fittings, aircraft | 9 | 25 |
| Machinery and equipment | 8 | 20 |
| Radar equipment | 9 | 25 |
| Railway cars | 35 | 10 |
| Railway locomotives | 6 | 10 |
| Railway system | 4 | 6 |
| Railway track or grading | 1 | 10 |
| Railway traffic control or signalling equipment | 1 | 4 |
| Roads | 1 | 4 |
| Spare parts for an aircraft | 9 | 25 |

**Source: Canadian Tax Foundation publications.**

*Table 18*
### CCA RATES BY TYPE OF ASSET AND BY MODE

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Building construction | 4 | 4 | 4 |
| Engineering construction | 8 | 4 | 8 |
| Buses | na | 30 | na |
| Machinery and equipment | 10 | na | 25 |
| Capital items charged to operating expenses | 100 | 100 | 100 |

### B.1.3 Capital Asset Taxes and Property Taxes

Canadian capital asset taxes and property taxes enter into the equation for the marginal effective tax rate on capital in an additive fashion.

*Capital Asset Taxes:* General Canadian capital asset taxes are levied by Quebec, Ontario, Manitoba and Saskatchewan on asset values yearly. These taxes are deductible from corporate income tax. The respective rates for the above listed provinces are: 0.5%, 0.3%, 0.4% and 0.25%.

*Property Taxes:* Property taxes have not been included in this study due to difficulties in finding disaggregated data for the modes under examination.

### B.1.4 Historical Depreciation Rates and Capital Weights

Table 19 contains a summary of weights in capital expenditures by category of asset; these weights were used to aggregate categorical marginal effective tax rates on capital in order to arrive at an overall rate for each mode.[24] Table 20 presents the useful service life[25] of each category of capital asset by mode as well as the equivalent constant declining-balance historical depreciation rate.

*Table 19*
SUMMARY OF WEIGHTS IN CAPITAL EXPENDITURES

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Building construction | 6.0 | 19.1 | 19.1 |
| Engineering construction | 62.3 | 1.1 | 1.1 |
| Buses | 0.0 | 79.0 | 0.0 |
| Machinery and equipment | 31.5 | 0.0 | 79.0 |
| Capital items charged to operating expenses | 0.2 | 0.8 | 0.8 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Source: Statistics Canada publication.**

*Table 20*
SUMMARY OF USEFUL SERVICE LIVES AND EQUIVALENT CONSTANT DECLINING-BALANCE DEPRECIATION RATES

| | Rail | | Bus | | Air | |
|---|---|---|---|---|---|---|
| | Years | Rate % | Years | Rate % | Years | Rate % |
| Building construction | 55 | 4 | 50 | 4 | 40 | 5 |
| Engineering construction | 55 | 4 | 55 | 4 | 50 | 4 |
| Buses | na | na | 10 | 20 | na | na |
| Machinery and equipment | 28 | 7 | na | na | 20 | 10 |
| Capital items charged to operating expenses | 5 | 40 | 5 | 40 | 5 | 40 |

**Source: Statistics Canada publications.**

## B.2 PAYROLL TAXES

This section provides a summary of payroll taxes at the federal and provincial levels. Employer contributions to the Canada/Quebec Pension Plans (CPP/QPP), federal unemployment insurance contributions (UIC) and provincial health and education payroll taxes have been taken into account. In the remainder of this section these taxes are itemized and discussed briefly.

*Canada/Quebec Pension Plans (CPP/QPP):* The Canada Pension Plan has been in effect since 1966 in all provinces in Canada except Quebec, which operates the Quebec Pension Plan under the same contribution rules as the CPP. Currently, maximum pensionable earnings of $30,500 and a basic exemption of $3,000 are taxed at 2.3%. Table 21 provides a summary of CPP/QPP rates and earnings ceilings for 1991, while Table 22 illustrates effective rates by income class where the rate is calculated for the upper limit of each income range presented.

*Table 21*

*CANADA/QUEBEC PENSION PLAN RATES FOR 1991*

| | |
|---|---|
| Maximum pensionable earnings ($) | 30,500 |
| Basic exemption ($) | 3,000 |
| **Contribution rate (%)** | |
| Employers | 2.3 |
| Employees | 2.3 |
| Self-employed | 4.6 |
| **Maximum contribution ($)** | |
| Employers | 632.50 |
| Employees | 632.50 |
| Self-employed | 1,265.00 |

**Source: Canadian Tax Foundation publications.**

### Table 22
### CPP/QPP EFFECTIVE RATES BY INCOME BRACKET, 1991

| Income (CAN$) | Effective rate (%) | | |
|---|---|---|---|
| | Employers | Employees | Self-employed |
| 0–30,500 | 2.3 | 2.3 | 4.6 |
| 30,501–35,000 | 2.0 | 2.0 | 4.0 |
| 35,001–40,000 | 1.7 | 1.7 | 3.4 |
| 40,001–45,000 | 1.5 | 1.5 | 3.0 |
| 45,001–50,000 | 1.3 | 1.3 | 2.7 |
| 50,001–55,000 | 1.2 | 1.2 | 2.4 |
| 55,001–60,000 | 1.1 | 1.1 | 2.2 |
| 60,001–65,000 | 1.0 | 1.0 | 2.0 |
| 65,001–70,000 | 0.9 | 0.9 | 1.9 |
| 70,001–75,000 | 0.9 | 0.9 | 1.8 |
| 75,001–80,000 | 0.8 | 0.8 | 1.6 |
| 80,001–100,000 | 0.7 | 0.7 | 1.3 |

*Unemployment Insurance Compensation (UIC):* Currently employers contribute 3.15% on maximum earnings of $35,360, while employees must contribute 2.5%. Table 23 provides a summary of effective UIC rates by income class; these rates are calculated for the upper limit of income in the income range presented.

### Table 23
### EFFECTIVE UNEMPLOYMENT INSURANCE COMMISSION (UIC) RATES BY INCOME BRACKET, 1991

| Income (CAN$) | Effective rate (%) | |
|---|---|---|
| | Employers | Employees |
| 0–30,500 | 0.37 | 0.34 |
| 30,501–35,000 | 3.18 | 3.00 |
| 35,001–40,000 | 2.78 | 2.62 |
| 40,001–45,000 | 2.48 | 2.33 |
| 45,001–50,000 | 2.23 | 2.10 |
| 50,001–55,000 | 2.03 | 1.91 |
| 55,001–60,000 | 1.86 | 1.75 |
| 60,001–65,000 | 1.71 | 1.61 |
| 65,001–70,000 | 1.59 | 1.50 |
| 70,001–75,000 | 1.49 | 1.40 |
| 75,001–80,000 | 1.39 | 1.31 |
| 80,001–100,000 | 1.11 | 1.05 |

*Provincial Payroll Taxes and Health-Care Premiums:* Payroll taxes are levied on employers' payrolls by four provinces — Newfoundland, Quebec, Ontario and Manitoba — while Alberta and British Columbia levy health-care premiums. Table 24 presents the current rates and premiums for payroll taxes and health-care premiums. Table 25 shows effective tax rates for health care in Alberta and British Columbia for single individuals and families.

*Table 24*
### PROVINCIAL PAYROLL TAXES, 1991

| Province | Payroll taxes (%) | Health-care premiums (yearly) (CAN$) | |
|---|---|---|---|
| | | **Single** | **Family** |
| Newfoundland | 1.5 | na | na |
| Prince Edward Island | na | na | na |
| Nova Scotia | na | na | na |
| New Brunswick | na | na | na |
| Quebec | 3.45 | na | na |
| Ontario | 0.98/1.95 | na | na |
| Manitoba | 0/2.5/3.5 | na | na |
| Saskatchewan | na | na | na |
| Alberta | na | 276 | 552 |
| British Columbia | na | 372 | 744 |

*Table 25*
### EFFECTIVE RATES FOR HEALTH-CARE PREMIUMS BY INCOME BRACKET, 1991

| Income (CAN$) | Alberta | | British Columbia | |
|---|---|---|---|---|
| | **Single (%)** | **Family (%)** | **Single (%)** | **Family (%)** |
| 0–30,500 | 0.09 | 0.18 | 0.12 | 0.24 |
| 30,501–35,000 | 0.79 | 1.58 | 1.06 | 2.13 |
| 35,001–40,000 | 0.69 | 1.38 | 0.93 | 1.86 |
| 40,001–45,000 | 0.61 | 1.23 | 0.83 | 1.65 |
| 45,001–50,000 | 0.55 | 1.10 | 0.74 | 1.49 |
| 50,001–55,000 | 0.50 | 1.00 | 0.68 | 1.35 |
| 55,001–60,000 | 0.46 | 0.92 | 0.62 | 1.24 |
| 60,001–65,000 | 0.42 | 0.85 | 0.57 | 1.14 |
| 65,001–70,000 | 0.39 | 0.79 | 0.53 | 1.06 |
| 70,001–75,000 | 0.37 | 0.74 | 0.50 | 0.99 |
| 75,001–80,000 | 0.35 | 0.69 | 0.47 | 0.93 |
| 80,001–100,000 | 0.28 | 0.55 | 0.37 | 0.74 |

Two different marginal effective tax rates were computed on labour; one rate was defined by income class, while the other was aggregated for each mode using employment statistics available from Statistics Canada publications. The rate defined by income class and presented in the main body of the paper was simply an average of all the above federal and provincial rates.

## B.3 FUEL TAXES

In this section, the data used to determine the marginal effective tax rate on fuel for each mode are presented. Before proceeding with summaries of provincial and federal fuel taxes, it should be noted that conversations with industry officials indicate that commercial/industrial fuel prices are representative of industry average prices.[26] Fuel that is purchased as a final product is classified as retail, while fuel that is purchased from the refinery as raw material is classified as commercial/industrial. The analysis was carried out for both categories of fuel under the assumption that any one carrier may be qualified to purchase fuel under one category or another but not both.

In Canada, provinces levy taxes on fuels of different types and different vendor categories. Quebec, Ontario, Manitoba, Saskatchewan and Alberta levy per-unit excise taxes on fuels, while the remaining provinces levy *ad valorem* taxes based on prices observed by provincial ministers.

In addition to provincial fuel taxes, the federal government levies a four cents per litre excise tax on all fuels. This was converted into an effective *ad valorem* rate using Canadian average fuel prices.[27] Combined federal and provincial *ad valorem* tax rates on fuels are summarized in Table 26.

For each mode of transportation, the effective provincial tax rate was calculated as a weighted average of the tax rates, where the weights are equal to the proportion of fuel consumption in a province to total fuel consumption.[28]

Finally, to arrive at an overall effective rate on fuel by mode, Statistics Canada information on proportions of fuel types used within a mode was employed. This was then combined with the figures contained in Table 26 to arrive at the marginal effective tax rates on fuel, shown in Table 4.

*Table 26*

### AVERAGE SALES PRICES (NET-OF-TAX) FOR FUELS, UNIT TAXES AND EQUIVALENT AD VALOREM TAX RATES (COMBINED PROVINCIAL AND FEDERAL TAXES)

| | Nfld. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. |
|---|---|---|---|---|---|---|---|---|---|---|
| Diesel | 24.4 | 24.4 | 24.4 | 24.4 | 21.7 | 23.4 | 22.0 | 22.0 | 22.0 | 22.6 |
| Federal excise tax | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Provincial tax | 15.6 | 12.4 | 16.2 | 13.7 | 11.5 | 10.9 | 9.9 | 10.0 | 7.0 | 11.2 |
| Total tax (¢/L) | 19.6 | 16.4 | 20.2 | 17.7 | 15.5 | 14.9 | 13.9 | 14.0 | 11.0 | 15.2 |
| Tax rate (%) | 80.3 | 67.2 | 82.8 | 72.5 | 71.6 | 63.7 | 63.2 | 63.6 | 50.0 | 67.2 |
| Locomotive diesel | 24.4 | 24.4 | 24.4 | 24.4 | 21.7 | 23.4 | 22.0 | 22.0 | 22.0 | 22.6 |
| Federal excise tax | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Provincial tax | 0.0 | 12.4 | 0.0 | 4.3 | 3.0 | 4.0 | 13.6 | 15.0 | 5.0 | 3.3 |
| Total tax (¢/L) | 4.0 | 16.4 | 4.0 | 8.3 | 7.0 | 8.0 | 17.6 | 19.0 | 9.0 | 7.3 |
| Tax rate (%) | 16.4 | 67.2 | 16.4 | 28.7 | 32.3 | 34.2 | 80.0 | 86.4 | 40.9 | 32.5 |
| Aviation turbine | 28.4 | 28.4 | 28.4 | 28.4 | 25.0 | 21.4 | 22.2 | 22.2 | 22.2 | 21.7 |
| Federal excise tax | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Provincial tax | 0.7 | 0.7 | 1.0 | 2.5 | 5.7 | 2.1 | 5.8 | 7.0 | 5.0 | 3.3 |
| Total tax (¢/L) | 4.7 | 4.7 | 5.0 | 6.5 | 9.7 | 6.1 | 9.8 | 11.0 | 9.0 | 7.3 |
| Tax rate (%) | 16.5 | 16.5 | 17.6 | 22.9 | 39.0 | 28.5 | 44.1 | 49.5 | 40.5 | 33.8 |
| Aviation gasoline | 44.1 | 44.1 | 44.1 | 44.1 | 41.7 | 41.4 | 41.6 | 41.6 | 41.6 | 42.6 |
| Federal excise tax | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 |
| Provincial tax | 0.7 | 0.7 | 1.0 | 2.5 | 7.6 | 2.1 | 5.8 | 7.0 | 5.0 | 3.3 |
| Total tax (¢/L) | 10.2 | 10.2 | 10.5 | 12.0 | 17.1 | 11.6 | 15.3 | 16.5 | 14.5 | 12.8 |
| Tax rate (%) | 23.1 | 23.1 | 23.8 | 27.2 | 41.1 | 28.0 | 36.8 | 39.7 | 34.9 | 30.1 |

**Notes: All price data are net-of-tax and were obtained from Energy, Mines and Resources Canada (EMR); data are available on a regional rather than on a provincial basis. Tax data are for April 1, 1991 (locomotive diesel tax data are for May 1991 and were obtained from provincial governments) and are taken from the following EMR publication: *Federal and Provincial Petroleum Product Taxes*, Vol. 3, June 1991. Note that the provincial tax for Quebec includes 8% PST; this tax is not levied on locomotive fuel. Prices of road and locomotive diesel are identical and are those charged to commercial and industrial customers. Information obtained from various railway and bus companies in Canada indicates that these prices are representative. Bus industry officials suggest that theirs is a diesel based industry; therefore, we assume that diesel is the only fuel used by the bus industry. So far as aviation gasoline is concerned, EMR suggests that the large majority is leaded; therefore, a federal excise tax of 9.5 cents is used (rather than 8.5 cents for unleaded).**

# APPENDIX C: UNITED STATES STATUTORY TAX RATES AND AGGREGATION DATA

This section contains a summary of U.S. tax instruments that affect labour, capital and fuel in the transportation industry. Corporate income taxation and capital cost provisions of the U.S. tax system are discussed first. The methodology used to compute $t_i$, $i = k,l,f$, for the U.S. tax system is identical to the one used for the Canadian computations; also, the data and parameters used for aggregation purposes are those employed in the Canadian study.

## C.1 CAPITAL TAXES

### C.1.1 U.S. Corporate Taxes

In the United States, corporate tax rates are graduated at very low levels of income, with a maximum rate of 34% applied to income in excess of $75,000. To prevent large corporations from benefiting from the graduated tax rates at low income levels, taxable income between $100,000 and $335,000 is taxed at 39%, rather than the basic 34% rate. This serves to phase out the benefits of the graduated rate structure for corporations earning more than $100,000, completely eliminating it for firms earning more than $335,000 by subjecting these corporations to a flat 34% tax rate at the federal level.

Forty-five U.S. states levy a corporate income tax; of these, eight use a tax base which differs slightly from the federal base — Alabama, Arkansas, Louisiana, Minnesota, Mississippi, Montana, Utah and Wisconsin. Most of the states have mildly progressive rate structures at very low levels of income.

State income taxes are deductible from the federal base. This lowers the effective statutory tax rates of the states by a factor of one minus the federal tax rate. The average state tax rate, based on the highest tax brackets in each state, is about 6.6%. Thus, allowing for the deductibility of state from federal taxes, the average corporate tax rate in the United States is approximately 40.49% This is the rate used in the above calculations. However, significant differences exist across states.

For example, for the five U.S. states which levy no corporate income tax (Nevada, South Dakota, Texas, Washington and Wyoming), the total tax rate is the basic federal rate of 34%. The U.S. state with the highest tax rate is Pennsylvania, at 12%, implying a 41.92% combined tax rate. Table 27 provides a list of U.S. state tax rates for 1992.

Table 27

## U.S. STATUTORY CORPORATE INCOME TAX RATES

| State | (%) |
|---|---|
| Maine | 8.9 |
| New Hampshire | 8.3 |
| Vermont | 9.0 |
| Massachusetts | 8.3 |
| Rhode Island | 8.0 |
| Connecticut | 11.5 |
| New York | 10.0 |
| New Jersey | 9.0 |
| Pennsylvania | 9.5 |
| Ohio | 9.2 |
| Indiana | 3.0 |
| Illinois | 4.0 |
| Michigan | 2.4 |
| Wisconsin | 7.9 |
| Minnesota | 12.0 |
| Iowa | 12.0 |
| Missouri | 5.0 |
| North Dakota | 10.5 |
| South Dakota | 0.0 |
| Nebraska | 6.7 |
| Kansas | 4.5 |
| Delaware | 8.7 |
| Maryland | 7.0 |
| Virginia | 6.0 |
| West Virgina | 7.0 |
| North Carolina | 6.0 |
| South Carolina | 6.0 |
| Georgia | 6.0 |
| Florida | 5.5 |
| Kentucky | 7.3 |
| Tennessee | 6.0 |
| Alabama | 5.0 |
| Mississippi | 5.0 |
| Arkansas | 6.0 |
| Louisiana | 8.0 |
| Oklahoma | 5.0 |
| Texas | 0.0 |
| Montana | 6.8 |
| Idaho | 7.7 |
| Wyoming | 0.0 |
| Colorado | 6.0 |
| New Mexico | 7.6 |
| Arizona | 10.5 |
| Utah | 5.0 |
| Nevada | 0.0 |
| Washington | 0.0 |
| Oregon | 7.5 |
| California | 9.6 |
| Alaska | 9.4 |
| Hawaii | 6.4 |

### C.1.2 Capital Recovery

Depreciable assets include most tangible assets except land. Like Canada, the United States calculates depreciation allowances on the basis of the original cost of the asset rather than its replacement cost. The depreciation base is not indexed for the rate of inflation.

In the United States each asset is assigned an asset depreciation range (ADR) midpoint life which is stipulated by statute. The ADR lives are based on the estimated "useful life" of the asset. The ADR midpoints are grouped into various modified accelerated cost recovery system (MACRS) classes, each defining the period over which the capital expenditure is to be recovered: 3, 5, 7, 10, 15 or 20 years for machinery and equipment, and 31.5 years for non-residential structures. The MACRS recovery periods tend to be accelerated relative to the ADR midpoint lives. For example, seven-year property includes assets with ADR midpoint lives of 10 years but not less than 16. Property of 3, 5, 7 and 10 years is written off according to a 200% declining balance rule (two times the straight-line rate for the recovery period), with a switch to straight-line depreciation over the remaining recovery period when it is beneficial to do so. Property of 15 and 20 years is depreciated according to a 150% declining-balance rule (1.5 times the straight-line rate for the recovery period), with a switch to straight line. Non-residential buildings are written off on a straight-line basis over 31.5 years.

A put-in-use rule applies in the United States. This means that an asset may not be depreciated until the year in which it is placed in service, regardless of when it was purchased. A half-year convention applies in both the first and the last recovery years (or the year of disposition). The depreciation deduction in the first year of service is therefore one half of the amount that would normally be claimed for a full year of depreciation. In the final year of service life the firm can claim the other half year of depreciation. The effect is to add another year to the recovery period (that is, seven-year property is actually recovered over eight years).

By way of illustration, the depreciation allowances for seven-year property are given in Table 28 for a $100 expenditure while the relevant MACRS categories for the passenger transportation sector are shown in Table 29.

Table 28

### MACRS ALLOWANCE FOR SEVEN-YEAR PROPERTY

| Year | US$ |
|---|---|
| 1 | 14.29 |
| 2 | 24.49 |
| 3 | 17.49 |
| 4 | 12.49 |
| 5 | 8.92 |
| 6 | 8.92 |
| 7 | 8.92 |
| 8 | 4.47 |

Table 29

### MACRS CATEGORIES

| Category | Recovery period (years) |
|---|---|
| Buses used in the (urban and suburban) transportation of passengers | 5 |
| Railroad machinery and equipment (including locomotives, passenger and freight train cars, shops and roadway machines, signals and inter-lockers, etc.) | 7 |
| Air transportation assets (including aircraft fittings, radar, spare parts, etc.) | 7 |
| All buildings and structures (including hangers, terminals, bridges, trestles, water and fuel stations, station and office buildings, runways, railway track and grading, etc.) | 31.5 |

The list of assets contained in Table 29 was broken down into the five categories of capital expenditures: building construction, engineering construction, buses, and machinery and equipment. The present value of MACRS deductions using the Canadian financial parameters previously presented in Appendix B of the Canadian report were calculated. Summaries of the present values of MACRS deductions are presented for rail, bus and air in Table 30.

Table 30

### PRESENT TAX VALUE OF MACRS DEDUCTIONS BY MODE

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Building construction | 12 | 12 | 12 |
| Engineering construction | 12 | 12 | 12 |
| Buses | na | 31 | na |
| Machinery and equipment | 29 | na | 29 |

The U.S. tax code allows for nominal debt interest expenses to be deducted in full (as in Canada). The taxpayer may elect to capitalize interest by including it in the cost base of the asset and recovering the interest expenses through depreciation deductions. This may be desirable if it gives rise to an operating loss that could expire. There is no deduction for the opportunity cost of equity finance (either retained earnings or new share issues), nor are adjustments made for inflation to restrict deductibility to the real, as opposed to the nominal cost of debt.

### C.1.3 The Alternative Minimum Tax

The U.S. tax code contains provisions to ensure that "profitable" corporations pay at least a minimum amount of tax. The alternative minimum tax (AMT), introduced in the 1986 tax reform, is in fact a parallel tax which must be computed in addition to the regular corporate income tax (CIT): the actual payable tax is the greater of the two. The lack of data precludes the inclusion of the AMT in these calculations.

The $t_k$ calculations for the U.S. tax system were calculated using Canadian historical depreciation rates shown in Appendix B and presented again in Tables 31 and 32.

*Table 31*
*ECONOMIC DEPRECIATION RATES (DECLINING BALANCE) BY MODE AND ASSET CATEGORY*

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Building construction | 4 | 4 | 5 |
| Engineering construction | 4 | 4 | 4 |
| Buses | na | 20 | na |
| Machinery and equipment | 7 | na | 10 |
| Capital items charged to operating expenses | 40 | 40 | 40 |

*Table 32*
SUMMARY OF WEIGHTS IN CAPITAL EXPENDITURES

| | Rail | Bus | Air |
|---|---|---|---|
| | (%) | | |
| Building construction | 6.0 | 19.1 | 19.1 |
| Engineering construction | 62.3 | 1.1 | 1.1 |
| Buses | 0.0 | 79.0 | 0.0 |
| Machinery and equipment | 31.5 | 0.0 | 79.0 |
| Capital items charged to operating expenses | 0.2 | 0.8 | 0.8 |
| **Total** | **100.0** | **100.0** | **100.0** |

## C.2 U.S. PAYROLL TAXES

Payroll taxes in the United States are higher than payroll taxes in Canada. The U.S. federal government is entitled to levy social security taxes on employers and employees under the auspices of the *Federal Insurance Contribution Act* (FICA), while federal unemployment insurance taxes on employers are levied through the *Federal Unemployment Income Tax Act*. Individual states also levy unemployment taxes on employers.

*Federal Insurance Contribution Act:* All employers are required to withhold social security taxes and hospital insurance contributions from employees' wages; they must also match the employee contributions using their own funds. Social security levies are 7.51% on the first US$48,000 of gross wages. This limit was converted into an equivalent Canadian levy by assuming a 15% exchange rate on the U.S. dollar. U.S. social security rates and maximum contributions expressed in Canadian dollars are shown in Table 33, while Table 34 depicts the effective rate by Canadian income class in Canadian dollars.

*Table 33*
U.S. SOCIAL SECURITY RATES AND MAXIMUM CONTRIBUTIONS

| | |
|---|---|
| Maximum pensionable earnings (CAN$) | 55,200 |
| Basic exemption | 0 |
| **Contribution rate (%)** | |
| Employers | 7.5 |
| Employees | 7.5 |
| **Maximum contribution** (CAN$) | |
| Employers | 4,145.52 |
| Employees | 4,145.52 |

### Table 34

### Effective Social Security Rates by Income Class

| Income (CAN$) | Salary (CAN$) | Contribution (CAN$) | Employers (%) | Employees (%) |
|---|---|---|---|---|
| 0–30,500 | 30,500 | 2,290.55 | 7.51 | 7.51 |
| 30,501–35,000 | 35,000 | 2,628.50 | 7.51 | 7.51 |
| 35,001–40,000 | 40,000 | 3,004.00 | 7.51 | 7.51 |
| 40,001–45,000 | 45,000 | 3,379.50 | 7.51 | 7.51 |
| 45,001–50,000 | 50,000 | 3,755.00 | 7.51 | 7.51 |
| 50,001–55,000 | 55,000 | 4,130.50 | 7.51 | 7.51 |
| 55,001–60,000 | 60,000 | 4,145.52 | 6.91 | 6.91 |
| 60,001–65,000 | 65,000 | 4,145.52 | 6.38 | 6.38 |
| 65,001–70,000 | 70,000 | 4,145.52 | 5.92 | 5.92 |
| 70,001–75,000 | 75,000 | 4,145.52 | 5.53 | 5.53 |
| 75,001–80,000 | 80,000 | 4,145.52 | 5.18 | 5.18 |
| 80,001–100,000 | 100,000 | 4,145.52 | 4.15 | 4.15 |

*Federal Unemployment Tax Act:* The U.S. federal government levies a 6.2% tax, on employers only, on the first $7,000 paid in wages per employee. Employing a 15% exchange rate, a Canadian dollar maximum contribution of $499.10 was computed on the first CAN$8,050. Effective U.S. unemployment tax rates by Canadian income bracket are expressed in Table 35.

### Table 35

### Effective Unemployment Insurance Rates by Income Class

| Income (CAN$) | Salary (CAN$) | Contribution (CAN$) | Employers (%) |
|---|---|---|---|
| 0–30,500 | 30,500 | 499.1 | 1.64 |
| 30,501–35,000 | 35,000 | 499.1 | 1.43 |
| 35,001–40,000 | 40,000 | 499.1 | 1.25 |
| 40,001–45,000 | 45,000 | 499.1 | 1.11 |
| 45,001–50,000 | 50,000 | 499.1 | 1.00 |
| 50,001–55,000 | 55,000 | 499.1 | 0.91 |
| 55,001–60,000 | 60,000 | 499.1 | 0.83 |
| 60,001–65,000 | 65,000 | 499.1 | 0.77 |
| 65,001–70,000 | 70,000 | 499.1 | 0.71 |
| 70,001–75,000 | 75,000 | 499.1 | 0.67 |
| 75,001–80,000 | 80,000 | 499.1 | 0.62 |
| 80,001–100,000 | 100,000 | 499.1 | 0.50 |

*State Payroll Taxes:* Employers are required to contribute to state-funded unemployment insurance programs. The taxable wage base varies from state to state as do the individual tax rates. An average state rate of 2.7 percent was assumed on a maximum of US$7,000.

Table 36 shows combined U.S. effective social security tax rates and unemployment tax rates at the federal and state level. These combined rates were then weighted using Canadian employment statistics to arrive at a U.S. weighted marginal effective tax rate on labour.

*Table 36*

*Combined Effective Social Security Rates and Federal and State UIC Rates by Income Class (CAN$)*

| Income (CAN$) | Salary (CAN$) | Employers' contributions (%) | | |
|---|---|---|---|---|
| | | UIC | SS | UIC + SS |
| 0–30,500 | 30,500 | 2.35 | 7.51 | 9.86 |
| 30,501–35,000 | 35,000 | 2.05 | 7.51 | 9.56 |
| 35,001–40,000 | 40,000 | 1.79 | 7.51 | 9.30 |
| 40,001–45,000 | 45,000 | 1.59 | 7.51 | 9.10 |
| 45,001–50,000 | 50,000 | 1.43 | 7.51 | 8.94 |
| 50,001–55,000 | 55,000 | 1.30 | 7.51 | 8.81 |
| 55,001–60,000 | 60,000 | 1.19 | 6.91 | 8.10 |
| 60,001–65,000 | 65,000 | 1.10 | 6.38 | 7.48 |
| 65,001–70,000 | 70,000 | 1.02 | 5.92 | 6.95 |
| 70,001–75,000 | 75,000 | 0.96 | 5.53 | 6.48 |
| 75,001–80,000 | 80,000 | 0.90 | 5.18 | 6.08 |
| 80,001–100,000 | 100,000 | 0.72 | 4.15 | 4.86 |

## C.3 U.S. FUEL TAXES

The U.S. federal government levies an excise tax of 6.2 cents per litre on highway diesel and 0.8 cents per litre on locomotive diesel. There is no federal tax on aviation fuel in the United States. The weighted average of state fuel tax rates were calculated for Washington, Montana, North Dakota, Minnesota, Michigan, New York and Maine using Canadian fuel statistics. These weighted averages were then converted from U.S. dollar tax rates to Canadian dollar tax rates by applying an exchange ratio of 1.15 Canadian dollars for one American dollar. Then, using Canadian realization fuel prices for each type of fuel, the marginal effective tax rate on fuel for each mode was obtained. Table 37 depicts the combined federal and state excise taxes and equivalent *ad valorem* rates for the United States.

## Table 37
## COMBINED U.S. FEDERAL AND STATE FUEL TAX RATES

| | Highway diesel | | Locomotive diesel | | Aviation fuel | |
|---|---|---|---|---|---|---|
| **State** | **(%)** | **(CAN$ per L)** | **(%)** | **(CAN$ per L)** | **(%)** | **(CAN$ per L)** |
| Maine | 51 | 0.14 | 9 | 0.02 | 4 | 0.01 |
| New York | 58 | 0.18 | 9 | 0.02 | 20 | 0.04 |
| Michigan | 41 | 0.12 | 8 | 0.02 | 3 | 0.01 |
| Minnesota | 48 | 0.14 | 4 | 0.01 | 8 | 0.02 |
| North Dakota | 8 | 0.13 | 6 | 0.01 | 4 | 0.01 |
| Montana | 48 | 0.14 | 4 | 0.01 | 1 | 0.00 |
| Washington | 48 | 0.15 | 13 | 0.03 | 9 | 0.02 |

## ENDNOTES

We appreciate the assistance of Ashish Lall who obtained new data on fuel taxes and corrected earlier errors in empirical work. The remaining errors are of our own responsibility. The last author wishes to thank the Social Sciences and Humanities Research Council of Canada for its financial support.

1. In particular, data acquisition difficulties have precluded the inclusion of property taxes in the analysis. Excluding property taxes may, however, be justified on other grounds; see the discussion below.

2. The assumption of perfect competition is made for expositional purposes only, as the analysis also applies to an industry with a non-competitive industrial structure.

3. Note that in the calculations of $t_k$, relative price changes of capital assets are assumed to be zero (see Appendix A). This assumption does not qualitatively change the results.

4. See Appendix B for a summary of CCA rates.

5. See Appendix B for a summary of weights in capital expenditure.

6. Conversations with officials of various bus companies in Canada indicate that some large firms may be purchasing fuel at prices that are lower than those used here because some bus companies are members of buying cartels. Due to their confidential nature, these data were not released to us. Richard Lake of the Royal Commission on National Passenger Transportation suggested the use of a Canadian average (net-of-tax) price for bus diesel of 20 cents per litre, a federal excise tax of 4 cents per litre and provincial taxes of 11 cents per litre. This implies a tax rate for bus fuel of 75%. If these rates were used in the calculations in Table 5, the effective tax rate on marginal cost for the bus industry would rise only marginally from 21.0% to 21.7%.

7. The study abstracts from the international aspects of passenger transport and uses effective fuel tax rates in the commercial and industrial category for all modes.

8. Note that the bus industry has the lowest labour taxes and the highest share of labour in total cost.

9. The seven-year carry forward of operating losses applies to reported losses. Companies are allowed to carry forward capital losses and discretionary deductions indefinitely.

10. The federal government has announced a loss offset program whereby companies can reduce fuel excise taxes on diesel and aviation fuel by renouncing $10 of corporate income tax losses for a one dollar reduction in the federal excise tax. At a 40% corporate income tax rate, companies with a 15% discount rate would find that it would be profitable to give up corporate tax-loss deductions for an immediate reduction in the fuel tax, if the company does not expect to pay taxes for at least nine years or if the losses were about to expire.

11. Calculations indicate that the Canadian equivalent to the modified accelerated cost recovery system (MACRS) for seven-year property would be a CCA rate of 26%, while five-year property would require a CCA rate of 33%.

12. The effective U.S. tax rates on fuel were determined by calculating state and federal fuel taxes levied in the states that lie along the Canadian border. These taxes were weighted by applying provincial fuel consumption statistics to each state according to its geographical proximity to each province. This served as a proxy for state weights on fuel taxes.

13. In Canada the half-year convention applies to most classes of capital assets. In this case the present value of CCA deductions becomes:

$$Z^* = \frac{d}{2} = \left(1 - \frac{d}{2}\right) \frac{de^{-r^F} + \pi}{r^F + d + \pi}$$

14. There are limitations of this assumption to the analysis; however, it is far beyond the scope of this project to allow for elasticities of labour supply which differ from infinity.

15. See s. 124 and s. 124(3) of the *Income Tax Act*.

16. Regulation 400(2) of the *Income Tax Act* states that "a permanent establishment means a fixed place of business of the corporation, including an office, a workshop or a warehouse, and where the corporation does not have any fixed place of business it means the principal place in which the corporation's business is conducted."

17. Ontario, Alberta and Quebec are the only provinces that have not entered into this agreement with the federal government; however, the tax bases used in each of these provinces are similar enough to the federal base that any substantive differences can be assumed to be negligible.

18. It is worth noting that Ontario, Quebec and Alberta use the same allocation rules as the rest of the provinces even though they have not entered into an agreement with the federal government.

19. For tax purposes an equated track mile is the total of the number of miles of first main track, 80% of the number of miles of other main track and 50% of the number of miles of yard tracks and sidings.

20. Regulation 406 of the *Income Tax Act*.

21. Regulation 409 of the *Income Tax Act*.

22. Regulation 407 of the *Income Tax Act*.

23. This is the half-year convention referred to above.

24. The source for the capital stock weights was Statistics Canada, Catalogue No. 13-211. The mid-year net stock figures in constant dollars were used.

25. Useful service lives were obtained from Statistics Canada, Catalogue No. 13-211.

26. There are other fuel categories, but these are not generally applicable to transportation industries.

27. Canadian average fuel prices were obtained from Energy, Mines and Resources Canada and are current to April 1, 1991.

28. These weights were arrived at by computing end uses of fuel by mode and province according to Statistics Canada, Catalogue No. 57-003.

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# NOTES ON INTERCITY PASSENGER TRANSPORTATION TECHNOLOGY

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## INTRODUCTION

The following notes on passenger transportation technology relevant to Canadian intercity travel, and prospects for its intermediate future,[1] identify but do not explain the technologies or scientific principles involved. Rather, the perspective of the political scientist, economist, policy analyst, etc., is taken.

Two reasonably discrete sections follow. The first addresses amodal general technology issues pertinent to the Royal Commission's mandate. The second section discusses technology forecasting and provides a forecast of prospective technology relevant to Canadian intercity passenger transportation modes over the intermediate term (approximately 25 years).

## I. FUNDAMENTAL PRINCIPLES

The principles selected here include material that the reader doubtless already knows. They are stated here, however, to emphasize their importance and to contribute understanding and background relevant to often-advanced, technological solutions to Canada's transportation issues.

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## SPEED

Speed is usually the most important determinant of the competitive success of a passenger transportation technology. Obviously, speed (lower origin/destination time[2]) increases the attractiveness of a travel option to consumers, and they will pay more for speed. Less obvious but at least as important, particularly within a given mode, faster is generally *cheaper*. Although higher speeds increase fuel costs, they usually also increase system capacity. Most importantly, both labour and equipment productivity (generally a much more important cost item than fuel) improves almost linearly with speed.

## ENERGY CONSUMPTION

At intercity passenger transportation speeds, power requirements and fuel consumption are dominated by aerodynamic resistance. This resistance increases (for subsonic speeds) *as the square of* the speed but decreases with air density, and approaches zero at very high altitude. This is a powerful equation; all else equal, higher is much better. Thus, surface systems reach a practical limit while airborne technology can achieve ever increasing speeds by travelling at greater altitudes. High-speed (relatively) rail (and/or maglev which has the potential to be superior aerodynamically) may have a niche in the intermediate distance travel market — to 500 kilometres or conceivably even 1,000 kilometres — but it would seem that air will dominate longer distances, indefinitely.

## ALTERNATIVE FUELS

With only insignificant exception, Canadian intercity passenger transportation is powered by hydrocarbon fuels. Alternatives are commonly advanced on the premise that fossil fuels will be saved and carbon dioxide emissions avoided. Insofar as portable transportation fuels are necessary for most modes, petroleum (a convenient and light source of concentrated chemical energy) is uniquely suited to the purpose.

Every conversion of energy form (chemical, electrical, nuclear, compression, momentum, heat, etc.) is accompanied by substantial efficiency losses. Most often, losses exceed 50 percent. In general, heat (the "lowest" form of energy) is emitted and wasted. Energy-use patterns that require the fewest and simplest conversions are generally the most efficient use of society's diverse energy resources, both financially and in terms of energy conservation and minimizing emissions to the environment.

### Solar Power

While solar power can be used for space and water heating with minimal loss, its conversion into transportation fuel (which would involve a chain of conversions) would be very costly, and only a small fraction of the original energy would remain. Electricity, on the other hand, is ideal for the operation of motors, and the middle distillates of petroleum (diesel/furnace oil) are relatively efficient portable fuels. Presuming alternative demand, the use of these energy forms for space or water heating, while lower forms of energy such as solar were available, would be wasteful.

### Electricity

Battery-operated vehicles can serve to reduce urban emissions, and electrified rail has distinct advantages. At the margin and during peaks, however, in most of Canada, electricity is produced by burning coal, oil or natural gas. For rail, the provision of electricity from central generating stations is somewhat more energy- and emissions-efficient than separate diesel electric generators on each locomotive unit. Peak intercity (and urban/suburban) passenger travel demand, however, tends to coincide with periods of high household electricity consumption, and electrification would exacerbate the electric utilities' peak loading problems. This is not the case for battery power; batteries can be charged off-peak, but they are relatively inefficient, costly and have low capacity.

### Hydrogen

Hydrogen is a benign fuel; the sole product of its combustion is water vapour. This would be attractive in an urban setting. Hydrogen would also have particular advantages in supersonic flight; the vaporization of liquid hydrogen would provide needed cooling.

Hydrogen, however, does not occur naturally. It is commonly produced from hydrocarbons, particularly methane, but the net effect is less efficient with greater carbon dioxide emission than would be the case were the methane used directly as transportation fuel. Another economically attractive means of hydrogen production, the partial oxidation of coal, poses still more serious environmental problems. For urban areas, however, where air quality threatens the health of the population, the advantage of hydrogen as a clean fuel remains. The pollution is transferred to a remote site. Although hydrogen can be produced from the electrolysis of water, this is futile for electricity produced from carbon or hydrocarbon fuel. However, the use of surplus electricity (where the energy would otherwise be wasted) generated from nuclear or hydro facilities could achieve the desired end. Unfortunately, with present technology and the Canadian mix of electricity generation and markets, operating an electrolysis plant on surplus power alone would not be economic. Exacerbating this situation, hydrogen molecules are very small and light. Containment is a problem, and vessels for either liquid or absorbed hydrogen are heavy and very bulky.

Commercial production of portable hydrogen fuel by electrolysis would require enormous quantities of energy. It would take some 46 kilowatt hours to produce one kilogram of hydrogen gas and a further 11 kilowatt hours to liquefy it. To be competitive with hydrogen produced from methane or coal, electricity would have to be purchased for less than two cents per kilowatt hour. Ultimately, the widespread use of hydrogen as a transportation fuel may come, but only with power from nuclear fusion, or another dramatic (presumably nuclear) breakthrough in the production of cheap electricity. When this occurs, hydrogen should rapidly become an important transportation fuel.

### Alternative Hydrocarbon Fuels

A great deal of progress has been made in the use of a broader range of hydrocarbons as transportation fuel, including coal derivatives, methane and propane. This is important for the continued availability of affordable transportation fuel; for example, hydrocarbon fuels with engine-cooling properties, liquefied gases and/or chemicals could prove useful to future supersonic flight.

## GREENHOUSE EFFECT

It is possible to prevent or substantially reduce emissions of the most harmful polluting substances from internal combustion engines. However, chemical removal of carbon dioxide (responsible for 50 percent of the greenhouse effect) from emissions is scarcely conceivable and not currently contemplated. Unfortunately, the concentration of this natural and necessary component of the earth's atmosphere is increasing. There are fears, supported by logic and some empirical climatological research, that this increased carbon dioxide[3] will have (and is having) a deleterious effect on the world's climate. Primary concerns are further desertification and a reduced ability to produce food. Since the problem is worldwide, it seems logical to seek an international solution. Beyond the reduction of carbon dioxide emissions to levels that the biosphere can tolerate, however, no solution is apparent.

There is presently absolutely no incentive even to study the chemical fixation of carbon dioxide. It is doubtful that there could be for some decades. Large emission sources (electricity generating plants are the most obvious) that might lend themselves to chemical fixation approaches are few, and a technology that would not, itself, require enormous energy input is not apparent. (It is presumed that such technology would involve fixation as calcium carbonate — limestone.)

Perhaps as a pessimistic but necessary perspective, it seems that there is only limited commitment to the very much easier task of removing chemicals that cause acid rain (which has conspicuous regional and local, rather than only global, impact). It is also noted that the favoured solution to the effects of acid rain is natural or induced neutralization with calcium carbonate (with a consequent emission of carbon dioxide).

A fashionable response to the carbon dioxide problem is the planting of trees. Most frequently mentioned are the rain forests of the Amazon. Certainly, this restoration of (red soil) forests would be environmentally desirable but would do no more than re-fix the carbon emitted when they were cleared. This is important but it is not a long-term solution to emissions from fossil fuels. Mature red-soil forests, as these are, do not continue to fix carbon indefinitely; the carbon dioxide is naturally re-emitted to the atmosphere as the vegetation decays. Strange to note, Canadian (black soil) muskeg and swamp retain substantial quantities of carbon over the long term, but not in quantities that would solve the problem of fossil fuel emissions.

An analysis of tree-planting as a solution, in the Canadian context, puts this approach into perspective. Canada emits some 500 million tonnes of carbon dioxide annually. The global figure is 25 billion tonnes. A hectare of actively growing pine, under Southern Ontario conditions, would only fix a modest one to one-and-a-half tonnes of carbon (say five tonnes of carbon dioxide) annually. Even Canada does not have 100 million hectares of suitable land — for 150 billion trees; the total conversion of Prairie farmland to trees might contribute 25 million hectares.

Fixation as limestone is the most obvious technical answer for the removal of greenhouse gases; the question is, how can the natural process of the creation of limestone be accelerated or supplemented without exorbitant consumption of energy? The economic prospects of such a process, on either a national or a global scale, seem dismal. For a solution, it seems that society must look at the other side of the equation: How can carbon dioxide emissions be reduced?

Given the present state of scientific knowledge and the Canadian climate, the only feasible approach to achieve a dramatic reduction would seem to be large-scale substitution, for current fuels, of electricity and, produced from it, hydrogen. Further, this would only be acceptable were the power produced from hydroelectric and nuclear energy sources, and it would be very expensive — too expensive for the Canadian economy (in isolation) to withstand. Finally, non-urban passenger transportation accounts for approximately 7 percent of Canada's carbon dioxide emissions, and approximately 0.15 percent of global emissions.

# II. TECHNOLOGICAL PROSPECTS

## FORECASTING TRANSPORTATION TECHNOLOGY

Technological forecasting — the forecasting of what science will allow in the future — is difficult. The forecasting of whether a technology will prove economically viable in a future market is more difficult. And the forecasting of actual transportation implementation, where governments play so large a role in the market, is still more difficult, especially since transportation applications usually substantially lag behind scientific knowledge that enables them. The shorter-term horizon examined here is less difficult than looking farther ahead.

Except under highly unusual circumstances, technological possibility, in the sense of scientific theory and results that can be achieved in a laboratory, precedes any possible practical transportation application by at least a decade. Further, especially in aviation, most research and development that result in practical transportation applications for civilians will first emerge as technology developed for military or space exploration. The military/space path of technology that is ultimately implemented in civilian passenger transport gives insight into which applications are likely to lead technologically. It is logical to conclude that, with a military/space bias:

- Speed and performance will be favoured relative to efficiency, comfort, energy economy, etc.;
- Technology development will focus on more flexible and less vulnerable modes, free of fixed infrastructure (helicopters will receive the greatest relative attention, railways the least); and
- The air mode, particularly high-performance aircraft and those that require little or no runway, will receive most research.

With technological development, market and regulatory circumstances, particularly market imperfections, are at least as influential as scientific discovery and its potential economic benefits. The possible is not always realized; opportunities may be missed for reasons unrelated to applicable technology and the benefits achievable from it. For public (common carrier) transportation in particular, carrier and modal evolution falls short of the economically justifiable implementation of state-of-the-art technology, sometimes far short.

The cost and service characteristics of a transportation mode depend on the technology employed, restricted by whatever institutional constraints may apply. In an open competitive industry, one does not expect an appreciable lag between availability of a cost-effective technological advance and its implementation. Such lags may be attributable to the substantial cost of entry into the industry and a high degree of monopoly and regulation. In transportation, the high entry cost may be accompanied by a high level of operating complexity, with a consequence that long job-specific experience and the ability to keep the physical systems running are the essential managerial qualities. This, and the need for intercarrier compatibility, leads to retardation of innovation, both with respect to operations and to commercial practices. The railway industry, practically worldwide, is a classic example.

Also, in a society where less than total free enterprise prevails, regulatory restriction or the presence of government in the market has a restraining effect. The implementation of technological, financial and/or commercial innovation is further complicated by state ownership of some transportation infrastructure and/or systems. Investment in government enterprises usually hinges on fiscal and sociopolitical factors as well as cost effectiveness. The views of employees, with respect to job security, tend to carry substantial weight, as do those of users of the system with respect to service convenience and price. Return on investment achievable from technological change is less dominant.

The cost and performance characteristics of emerging technology may have less influence on its development for transportation purposes than institutional influences relevant to its implementation. Also important is the corporate and/or government will to devote the resources necessary for research and development from scientific discovery to an operational reality. Such a process is more predictable in the case of an open, competitive equipment market (for example, automobiles or aircraft) than it is for common infrastructure (for example, air traffic control systems) or high entry-cost integrated systems (for example, maglev).

The process of technological innovation — the development of operational technology from scientific knowledge — is as much political as technical. In the short term, all elements of society do not benefit equally from new processes, especially capital-intensive, labour-saving ones. A particular institutional structure would encourage and support certain innovations, while obstructing others.

## AVIATION

The principal thrust of the development of fixed wing transport through the 1990s is expected to be achievement of comparable performance at reduced operating cost. Lighter weight composite materials, involving lighter and more rigid alloys, synthetics and metal/synthetic sandwich construction could see progressively increased use. New wing designs, including controlled surface permeability and thicker sections, could achieve aerodynamic efficiencies such that equivalent or greater lift would be provided by smaller, lighter structures. Turbojet engines could be lighter and quieter, and some 20 percent more fuel efficient. Still greater fuel economy, however, could be achieved through propulsor blade-powered (fan) engines. These would be capable of mach .7 or .8 at fuel economies of 35 to 40 percent over present jet engines.

High-capacity freight transports, developed for military applications, could see increasing civilian application. Through to the turn of the century, however, only a marginal increase in the passenger capacity of the largest aircraft is foreseen, with B-747 derivatives accommodating up to 600 passengers. More importantly, it is anticipated that, by the turn of the century, carriers will be able to choose from a broader, virtually continuous spectrum of capacity, range and speed. Turboprop aircraft, most suited to shorter-range applications, could be available in higher capacities — to 100 seats — and capable of operating at speeds to mach .6 with propulsor fans adapted to aircraft as small as the de Havilland Dash 8.

Helicopters are inherently extravagant and relatively slow. Their use for more than short distances is expected to be limited to unusual circumstances. Civilian versions of military powered lift (probably tiltrotor) developments should become available in the early 21st century. It is interesting to note that cancellation of the U.S. military tiltrotor development program is being opposed on the grounds of future civilian applications. These aircraft, capable of 500 kilometres per hour, will combine helicopter manoeuvrability with the speeds of fixed wing aircraft. They will be designed for the city centre market that STOL (Short Take-Off and Landing) failed to develop, but the economics of such an operation are still uncertain.

The demise of the U.S. Supersonic Transport (SST) program and the limited success of the Concorde notwithstanding, a second-generation, supersonic passenger transport is anticipated. In operation by the middle of the first quarter of the 21st century, this aircraft would fly at three times the speed of sound and cruise at an extremely high altitude, perhaps 75,000 feet. With a 12,000-mile range, it would be designed exclusively for long-distance intercontinental travel, particularly trans-Pacific routes. Although hypothetical at this stage, economics would demand a substantially greater capacity than Concorde — at least 350 seats. Suborbital transports, capable of mach 5 and greater, seem dominated economically by the mach 3 or 3.5 SST. Offshoots of the space program, their development would depend on total government financing.

The most important technological advances in the aircraft of the early 21st century could be invisible to the casual observer. The controls of large aircraft would be electrical/mechanical and computerized. Aerodynamic surfaces could be instrumented and attached to a pair of control computers by hard-wired, probably fibre-optic, electronics. Aerodynamic pressures could be sensed, readings credibility checked through an on-board artificial intelligence system, and adjustments made automatically. Engines could be similarly monitored and controlled. The above, and navigation system advances discussed below, could permit operation with little or no human intervention.

Aircraft maintenance will doubtless be increasingly mechanized. Diagnostic test equipment would be pervasive and sophisticated. Engines and other mechanical equipment could be monitored in service with microelectronic sensors reporting to intelligent computers for comparison with normal and abnormal histories of performance degradation. Maintenance cycles based on flight times could be largely replaced by identification of incipient failure. On-board computers could integrate the condition of all components, and the aircraft could be delivered to maintenance with a listing of necessary work. Inspection could be greatly reduced, with corresponding reductions in maintenance cost and time out of service for maintenance.

The pivotal element in navigation systems for the 21st century is anticipated to be a computerized, worldwide, satellite-based, aircraft-location, identification system. All commercial aircraft of participating countries could be located in three dimensions within a few metres by means of identification transponders. This system could be paired with an independent radar-based collision avoidance system on each aircraft. Weather information would also be assembled from satellite instrumentation and communicated by an artificial intelligence (really *expert systems*) computer system to each aircraft in real time. The artificial intelligence system would communicate only new information relevant to the flight in question, updating the on-board visual display. The weather information would also flow, of course, to the traffic control system, where it would serve as input to the runway use (re)configuration, routing, and take-off and landing scheduling functions — also computerized.

Voice contact between controller and aircraft would not be necessary. Instructions and/or advice could be visually displayed on-board, and communicated directly to the two on-board navigation computers. There, they could be compared automatically with the aircraft's location, direction and speed and double checked against the readings from the collision avoidance system. On-board altitude would be measured and automatically compared with that computed as appropriate by the navigation system. Necessary control adjustment sequences, achieving the stipulated parameters at minimum fuel consumption, would be prepared. Before adjustments are made, the computers' artificial intelligence memories and the collision avoidance system would be automatically consulted for unsafe conditions.

How much pilot confirmation is needed prior to course correction would depend largely on public acceptance of automatic operation.

Labour and nationalist considerations, power failure and hostile acts aside, one air traffic control centre would suffice for North America. Two such centres at dispersed locations would provide backup to protect against a serious emergency at either one. Such a system could remotely control traffic in and out of all controlled airports. The computer system would plan flight paths and, considering weather conditions, each aircraft would be scheduled, before take off, for landing at its destination, with changes only occurring because of emergencies or unexpected weather. Landing queues would be virtually eliminated and, most importantly, aircraft separations would be reduced and airway capacity dramatically increased. Other obvious results of this technology would be an end to the air traffic controller's function as we now know it, an increase in fuel economy and improved safety.

Computer reservation systems currently track the movement of each passenger. By the turn of the century, these systems could be able to interpret early bookings against the history of demand for the service, predict evolving demand, and adjust capacity offered at various fares to maximize revenues. Increasingly sophisticated equipment-planning software could permit carriers to match capacity more closely to fluctuations in demand. Both yields and load factors should rise.

Technology for terminals would include containerized baggage and cargo handling, with automated aircraft loading enabling faster turnaround. The science of security screening is in its infancy, and the technology of remotely identifying forbidden objects and substances could be greatly advanced.

Artificial intelligence systems could aid in the identification of potential offenders. On the other hand, the ingenuity of those bent on defeating the system will continue to advance.

The aeronautical industry has traditionally pursued technological advances well before such would be justified on purely economic grounds. The aircraft manufacturing industry throughout the world is heavily subsidized, both directly and under the guise of national defence. Particularly important in the United States, development costs can be written off against defence work. This was the case for the B-707, and would apply to tiltrotor and suborbital mach 5 transports. Regardless of Canada's attitude to subsidizing its aeronautical industry, Canadian carriers will have access to aircraft technology, the development of which was publicly subsidized by the nation of origin.

Technology for terminals is less advanced than that for aircraft, and government support of research is modest, except with respect to physical accessibility for people with mobility impairments, and signage and emergency warning systems for those with impaired hearing or sight. Automated information systems and translation systems could be developed and implemented at publicly owned airports.

## GUIDED GROUND PASSENGER TRAVEL

Although the science that enables intercity, repulsive-mode maglev has been known for two decades, development and demonstration of this technology are expensive, and there are no military applications against which such expenses could be defrayed. There is little doubt, however, that repulsive-mode magnetically levitated vehicle systems (maglev), capable of 500 kilometres per hour, could be developed. Driverless vehicles for perhaps 100 passengers would offer service quality comparable to air travel. Such a system was designed in Canada more than ten years ago (but not recommended for further Canadian development). The technology to make such vehicles work on an experimental basis has been developed; a Japanese prototype works.

Until recently the operational practicality of repulsive-mode maglev has remained in question because of the extremely low temperatures believed necessary for operation of the superconductive magnets that enable efficient levitation. However, what is presumed to be the final technological breakthrough necessary for commercial development of maglev systems — economical, moderate temperature superconductors — is rapidly advancing. The necessary electronic control systems and linear synchronous motors already exist. Infrastructure designs also exist, but there remain safety concerns. Such will doubtless be resolved overseas before a Canadian installation is considered.

Another high-technology prospect, attractive-mode maglev with linear synchronous motors, avoids the superconductivity problems of the repulsive-mode, and is currently being tested at full scale. Commercial implementation in Germany before the year 2000 is planned, and a Las Vegas–Los Angeles system has been proposed.

Driverless rail transit systems, employing linear induction motors and computerized control, are designed, manufactured and now operate in Canada. High-speed, automatic electric rail for transit or intercity application is the current technology available for installation.

Electrified railway passenger systems, designed for operation to 300 kilometres per hour, are operating commercially overseas, and are being considered for the U.S. and Canada. It is, however, significant to note that these are really *not* innovative technology. The use of microelectronics aside, present and proposed high-speed rail designs contain few technological features that were not available half a century ago. As for the microelectronics employed, the integration of infrastructure and vehicle operation characteristic of the rail mode is most compatible with implementation of the automated control systems made feasible through microelectronics and computers.

Sophisticated microelectronics, however, are not fundamental to high-speed, electrified railway operation, and more sophisticated applications are common in modern automated manufacturing processes (not to mention high-technology aircraft and the state-of-the-art car). This is not to demean high-speed rail. Rather, it is a suggestion that it be viewed as existing and mature technology. Replacement of some aircraft and car use by a less technological but fast fixed-infrastructure system might well be the choice of an environmentally aware 21st century society faced with air and highway congestion.

Progressing from the relatively low-technology high-speed rail currently being considered for the Quebec–Windsor corridor, driverless, high-speed railway systems could be operational in Canada early in the next century. Repulsive-mode maglev could be operating within a decade thereafter but will probably not be implemented in Canada before 2020.

## ROAD

Anticipated advances in shorter-run highway design are important but not spectacular. New pavements should be stronger, more frost resistant and more rigid, and chemicals may be added to the surface layer of asphalt to prevent the formation and adherence of black ice. Technological changes that could substantially affect road use are longer term. Dedicated controlled roads with automated electronic guidance, on which traffic could operate safely at high speeds and densities, are not far beyond the current state of technology. Because of diverse vehicle design, ownership and maintenance, however, questions of reliability remain far from resolution.

The underlying technology for vehicle guidance systems, usable even when all vehicles are not equipped for such a system, is close. The technology, whereby vehicles with increasing degrees of automatic operation travel ordinary roads in mixed traffic with unequipped vehicles, is under active development. Such vehicles would be capable of locating other vehicles, objects and road geometry, and would steer and adjust speed automatically. Operation of a mix of equipped and unequipped vehicles at substantially differing speeds, however, is physically difficult and poses safety problems.[4]

Some research is directed at automatic guidance without vehicle modification. It is not obvious, however, where the capital for such an investment, even for development of the technology, and an effective institutional mechanism, would come from. Short of the point where such systems would allow greatly reduced distances between vehicles, much higher speeds or driverless operation, automated driving is unlikely to have an important impact on highway cost or performance.

State-of-the-art microelectronic technology would permit economical implementation of sophisticated user-charge systems. Vehicle-mounted "smart" cards, issued with the vehicle licence, could be read by roadside sensors communicating with central computers. User-fees could then be assessed according to the road used and the time of the day, week or year.[5] Operating in conjunction with reliable automatic weigh scales, which could record at road speed, the system would be able to factor weight into the user-charge.

The key to improving the cost effectiveness of intercity bus on high-density routes is to increase the capacity of the vehicles. Capacity and size also govern seat comfort. A few more inches of width would allow rail-competitive seating; the alternative is two + one seating with 22 to 25 percent loss of capacity. Relaxation of the width constraint is not foreseen for the shorter term. The alternative would seem to be longer and/or higher coaches. Capacities of the order of 100 seats, if they could be achieved, would allow substantial economies of labour, and improve modal competitiveness. They would improve the economics of shorter-distance, intercity travel more than any foreseen technological improvement.

The most likely configuration would seem to be a double-decked unit, but a conventional double-decked bus would be unable to negotiate many underpasses. Articulated designs are in experimental use, and a triple design with a separate trailer has been suggested. A double-deck design (except at the rear end) with a height below five metres would be possible if the chassis were lowered. For 100 seats, an articulated double is indicated.

Improved (active) suspension and (anti-lock) braking systems would provide the necessary high-speed stability for a larger bus to operate safely and comfortably. Such vehicles, with professional drivers, could safely travel significantly faster than mixed traffic, were a dedicated right-of-way provided. Technology to improve the safety of faster vehicles within mixed traffic is conceivable. With implementation being politically questionable, however, economic incentive for its development is lacking.

With state-of-the-art technology, vehicle speeds could increase without corresponding increases in damage to the roadway or a deterioration in safety. The alternative is reduced wear and increased safety at current speeds. Active (microelectronically controlled) suspensions could improve passenger comfort, reduce dynamic loading and improve stability. Microelectronics will enable resistance-sensitive, skid-control braking systems, and monitoring of axle load distribution and automatic headways. Intelligent braking systems, balancing application to each wheel on the basis of sensed resistance, will doubtless make buses and cars safer.

Instrumentation and computer control of engine and transmission would improve fuel economy, as could the use of ceramics and higher combustion temperatures within engines. Related is improved tolerance for a broader range of fuels, particularly (for diesels) with respect to cetane number.

Ergonomic improvements in cars and buses are continuing. Included are seating improvements, reduced noise, digital instrumentation, electronic controls and dashboard convenience. With a single driver, and total human control a constant factor, ergonomics offer a greater potential for road than for the other modes. In buses, microcomputers monitoring mechanical and electrical systems would allow maintenance on an exception basis, and would improve reliability and on-time performance.

The size of the car market suggests a greater incentive for investment in technological research than is the case for buses. On the other hand, the investment necessary to equip a bus with advanced technology can be written off against several times the mileage of the average car, and much greater fuel consumption.

Innovative passenger car designs abound. They always have, and doubtless the future will be replete with them. Very small vehicles have been introduced before but have not survived. If appreciably smaller vehicles are to occupy a significant position in the transportation scene,[6] it will probably be by means of a progressive extension of the small end of a manufacturer's size range. Introduction of dramatic new designs is less likely. The exception to this could be vehicles with revolutionary new two-stroke internal combustion or superconductive electric motors. A three-cylinder, two-stroke engine could improve fuel economy by 10 percent.

Car energy efficiency can be improved in three basic ways: reduced vehicle weight has a proportionate effect on energy used for acceleration and lost in braking; frictional resistance includes tire/road loss (approximately constant for a given gross vehicle weight), and aerodynamic friction which depends on vehicle volume and shape but, most importantly, on speed;[7] and improved engine and mechanical efficiency.

Vehicle weights could be reduced by a mechanical design that allows more efficient use of vehicle volume; front-wheel drive has allowed a 5 to 10 percent weight reduction. Similarly, reduced use of mild steel and its replacement with high-strength alloys and other metals, particularly aluminum, synthetics and composite materials, should allow a weight reduction of 10 percent by 2010. There could be weight reduction in smaller vehicles, but consumer resistance to lighter vehicles, based on occupant safety considerations, must be recognized. The change in momentum of the occupants of rolling vehicles in collision (a major determinant of injury) is the inverse of the relative weights of the vehicles; all else equal, occupants of the lighter vehicle will suffer more. Of course, if both vehicles were proportionately smaller, there would be no differential effect.

Although its thermal efficiency is not high, revolutionary replacement of the reciprocating internal combustion engine is not predicted for the next few decades. However, incremental improvements are expected. In general, an internal combustion engine has two types of losses: those relating to thermodynamic efficiency and heat recovery, and those related to friction, both mechanical and aerodynamic/fluid-dynamic (pumping). Improvements should include increased use of overhead cam engines, four- and five-speed automatic transmissions, improved lubricating oil, four- and five-valve engines, multipoint fuel injection and automatically varied compression ratio and cylinder displacement. By 2010, these innovations could improve thermal efficiency by 7%, reduce pumping loss by 65%, and friction losses by 40%. In total, the above would not match the potential of the diesel engine which has a 20% to 30% advantage over the gasoline engine.

Gains from aerodynamic improvements show lower relative potential, a fact that affects total, achievable, energy-efficiency improvements, particularly at highway speeds where aerodynamic resistance is so dominant. Overall, the next 20 years could see a 50 percent improvement in specific fleet, average-fuel economy, much of it relating to the retirement of older-model vehicles presently in operation. From the perspective of the Royal Commission, intercity car energy efficiency will have much less impact. Most of the projected technology will have greater impact on urban/suburban fuel economy.

## MARINE

Passenger ferries on both coasts have become larger and faster in recent years. In the face of steadily increasing demand and increasing real labour costs, this trend can be expected to continue. Multiple and complex hull and hydrofoil designs, in use elsewhere and which offer higher speed, could see greater use in Canada. However, neither is the technology new, nor have past Canadian experiments with such vessels been particularly successful.

Automation technology will be implemented to some extent. For passenger services, however, potential passenger control and evacuation in an emergency are factors, docking is more frequent, and restaurants and other facilities must be staffed. Thus, the scope for labour economies is less. With their restricted routings, and schedule sensitivity, ferries are prime candidates for automated navigation. All control would be from the bridge, and crew roles could be reduced to a monitoring function, with direct control only taken on exception.

Engine condition could be monitored electronically, probably using fibre-optic circuitry, and maintenance could be scheduled on the basis of incipient problems detected. Marine diesel engines of current design can exceed 40 percent thermal efficiency. Ceramics and consequent higher-temperature operation could improve this still further and, more importantly, ceramic engines would tolerate broader fuel specifications and hence cheaper fuels.

## INTERMODAL

Exotic ideas for intermodal passenger capsules emerge periodically but have never come to anything. Walking out of one vehicle and into another does not seem to be a major deterrent to the multistage journey, as long as the connecting vehicle can be boarded conveniently, the walk is short and there is no delay. Rather than an exotic vehicle, the primary technological need is for improved design of transportation systems. Better systems will open the door to innovative design of terminals.

Most intercity travel is intermodal; for example, taxi-walk-escalator-walk-airplane-bus-walk. Intermodal travel need not involve more than one line-haul carrier, mode or vehicle. The future will doubtless see improvements in the technology of many of the modal links concerned, which will improve quality of travel. So will improvements to the nodes (terminals). The greatest improvement expected within the next decade, however, will not involve the transport itself but rather the delays and activities at the nodes between the links.

Improvements to intermodal systems are expected to include airline check-in remote from the airport (before boarding the airport bus or connecting train), origin-destination intermodal baggage handling, intermodal reservation systems and intermodal ticketing. On-line multimodal scheduling systems would synchronize the capacity and departures of connecting carriers with arriving passengers (not just the capacity of the vehicles concerned, but the actual number of passengers boarding). For example, the transit system departing from the airport would have capacity that is consistent with the number of incoming air passengers and the history of onward modal travel of those passengers.

The technology involved would be computer systems, both the high-capacity hardware and the scheduling and expert systems software necessary for its operation. Such systems would bestow competitive advantage to the multimodal carriers or cooperating modal carriers that subscribe. They would also serve to reduce congestion and improve travel at larger terminals, particularly airports.

## ENDNOTES

1. These notes are the result of preparation of an initial draft and its review with transportation technology specialists. Some of the material is taken from *Canadian Transportation in 2000 and 2015: Environmental Scanning Study* by the Research and Traffic Group for Transport Canada, and the continuing update of that material.

2. Travellers assess their alternatives in terms of the total time from departure at origin (home, office, etc.) to arrival at the ultimate destination. Allowances are also included for anticipated arrival delay and for (schedule) convenience with respect to desired arrival/departure time. In this regard, vehicle speed is only one element.

3. There are a number of substances emitted from transportation vehicles and systems that contribute to warming of the global atmosphere and the predicted climatic change colloquially referred to as the *greenhouse effect.* These include methane, nitrous oxide, sulphur dioxide, ozone and chlorofluorocarbons and carbon monoxide, but the predominant emission of concern is carbon dioxide. Although on a unit basis the other greenhouse gases are an order of magnitude more harmful to the atmosphere, it is carbon dioxide that has received the greatest attention, and rightly so. Quantities of carbon dioxide emitted overshadow those of all other gases, and opportunities to significantly ameliorate the problems posed by carbon dioxide are not apparent.

4. Here is the essence of the intercity bus limitation. Modern intercity coaches with trained and experienced drivers can safely negotiate most roads at speed substantially above speed limits. Were they to do so in mixed traffic, however, passing situations and the effect on less equipped motorists would detract from safety.

5. Imp[illegible]s to the implementation of such a system are not likely to be technological or economic. Rather, a system that tracks vehicles in space and time could (used with insufficient security) constitute an invasion of privacy.

6 Smaller vehicles have been suggested as a solution to congestion. However, safe capacity is dictated by speed, driver reaction and vehicle stopping time. Vehicle length is of minor consequence, and the impact of some small vehicles tends to be perverse. As regards highway capacity, a fleet of identical vehicles would be optimal.

7. For a vehicle with aerodynamic resistance of one (force) unit at 25 kilometres per hour, a doubling of the speed to 50 kilometres per hour would increase resisting force by a factor of approximately 3.5. Doubling it again, to 100 kilometres per hour, would increase aerodynamic resisting force a further four or five fold. A trend towards increasing mean vehicle speeds could rapidly neutralize any gains through fuel efficiency technological improvement. As an indication of the magnitude of this effect, it is estimated that the difference between a vehicle speed of 77 kilometres per hour and one of 100 kilometres per hour causes a 20 percent increment in per kilometre fuel consumption. As mentioned above, improving technology should allow higher vehicle speeds without loss of safety.